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computing today

FOR A PERSONAL APPROACH TO MICROCOMPUTING

JULY 1982
ISSN 0142-7210
75p

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Major programming feature inside

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Hands-on report on Sharp's latest hand-held

Upgrade your NASCOM with our utility package

First Bytes? Last Bit!

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Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.

All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

You can't get a Home Computer from Texas Instruments under 16 K RAM.

Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

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With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages – UCSD-PASCAL, TI-LOGO and ASSEMBLER – and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide – including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.

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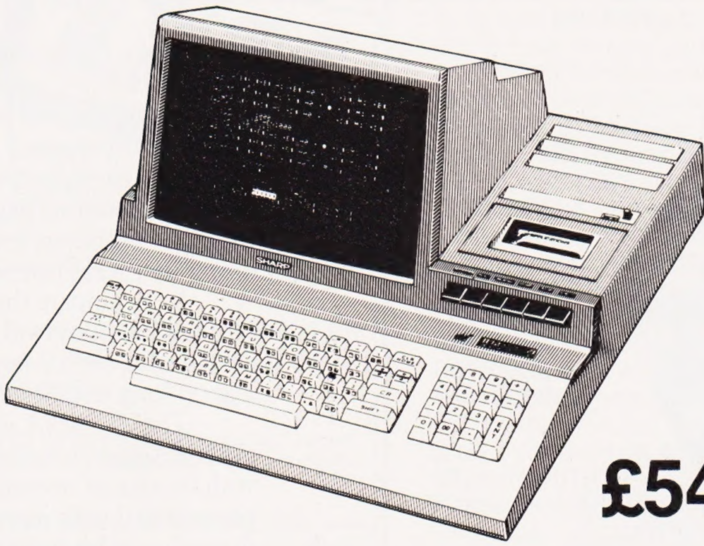

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By following the clues and overcoming the obstacles can you solve the mystery of the "DEATH SATELLITE" and unlock its secrets???

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In this 3D all action game, hi-resolution graphics are used to simulate the pilots view of space from the cockpit of his Starfighter.
Your instruments are constantly displayed and include - Long range scanner - Laser energy status - and fuel status. Score and Hi-score also displayed

Written in m/c for the ATOM using 5K text 6K graphic

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+ = 5K text 6K graphics ++ = 5K text 1/2 graphics
x = Floating Point Required

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Two popular games from our Atom range converted and enhanced to run on BOTH MODEL A & B MICRO's

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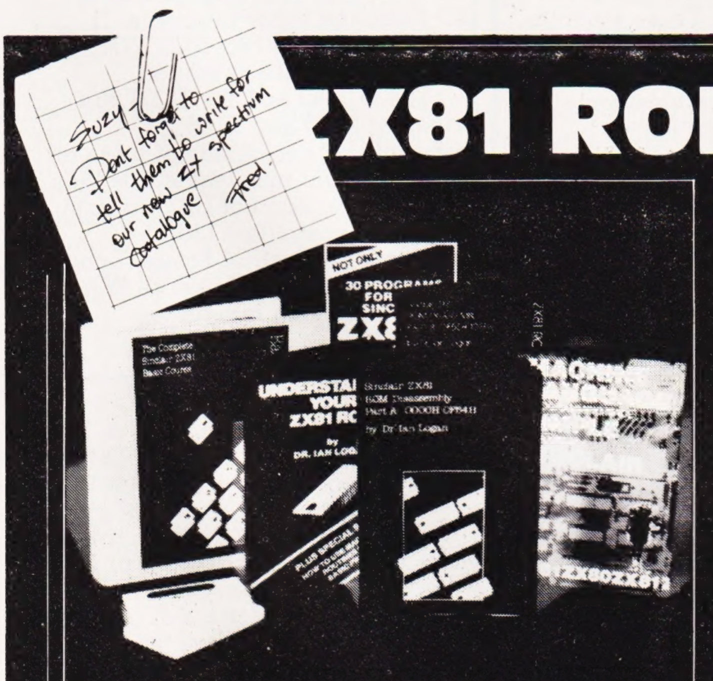
SPECIAL OFFER Deduct 1.00 per additional cassette when you order 2 or more programs

WE PAY 25% ROYALTIES ON YOUR PROGRAMS

ORDERS TO A&F SOFTWARE 10,WILPSHIRE AVE, LONGSIGHT, MANCHESTER, M12 5TL [Access/Barclay card on (061) 320 5482]

ZX81 ROM EXPOSED!



Dr. Ian Logan, winner of the 1981 Rosetta Stone Award has written three essential books for those who really want to understand the full working of the SINCLAIR ZX81!

Understanding Your ZX81 ROM

In this book Dr. Logan gives a complete overview of Z80 machine language using the ZX81 monitor program as an example. Dr. Logan explains the structure of the ZX81 ROM, its peculiarities, and how you can use the ZX81 ROM routines for your own purposes. PLUS a special section which shows how you can squeeze more power into your ZX81 by using machine language and machine language subroutines. Complete with example programs, reference tables, etc.

ZX81 ROM Disassembly Part A

This book is for the programmer that needs complete answers about the ZX81. Dr. Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from 0000H to 0F54H, and includes all functions except for the routines used in the floating point calculator.

ZX81 ROM Disassembly Part B

In this the companion volume to Part A Dr. Logan covers locations 0F55H to 1DFFH and includes all routines used in the ZX81 floating point calculator. Co-authored by Dr. Frank O'Hara.

OTHER TITLES AVAILABLE

- ★ **Machine Language Programming Made Simple for the Sinclair**
- ★ **Not Only 30 Programs for the Sinclair ZX81: 1K —**
- ★ **Complete Sinclair ZX81**

Basic Course is a 240 page in-depth comprehensive for complete beginners and experienced programmers. Over 100 programs and examples illustrate the use and possibilities of the Sinclair ZX81

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- every function covered
- BASIC Course programs available on cassette

Orders to Melbourne House Publishers, 131 Trafalgar Road, Greenwich London SE10
Correspondence to Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA

Name
Address
Postcode

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ZX81 ROM Disassembly Part B	£8.80
Understanding Your ZX81 ROM	£9.75

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CT

BUG BYTES

Ever had one of those days when you're wandering around your favourite valley, slaying monsters and finding the odd bit of treasure, when suddenly, you've either bounced off water, the stairs have disappeared or the screen's scrolled!

Well, as we here at CT get into Apology Mode, the corrections to the Valley program (published in April's Computing Today) are as follows:

```
2890  PRINT D$;"AN AMULET STONE..."
```

and

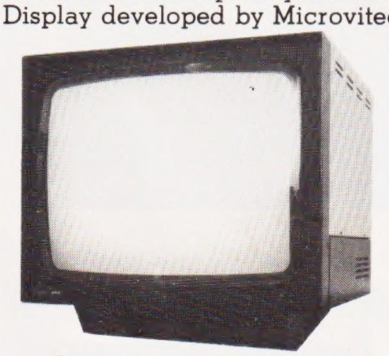
```
12080  PRINT "[HOM]";D2$;R2$;"[2 CR]
       [REV][2^SPC][OFF]"
12090  PRINT R2$;"[CR][REV][5^SPC]
       [OFF]"
12100  PRINT R2$;"[REV][2^SPC][OFF]
       [2 SPC][REV][2^SPC][OFF]"
12110  PRINT R2$;"[REV][2^SPC][^&]
       [OFF][SPC][REV][3^SPC][OFF]"
12120  PRINT R2$;"[CR][REV][4^SPC]
       [OFF][CR][REV][2^SPC][OFF]"
12130  PRINT R2$;"[3 CR][REV][2^SPC]
       [OFF]"
12140  PRINT R2$;"[4 CR][REV][^SPC]
       [OFF]"
```

Very sorry . . .it was an awfully long program though. Are we forgiven?

Also, we appear to have got a bit (subtle ASCII joke!) confused in the Aftermath article (see June issue). The caption to the picture of Ian McNaught-Davis should have read COI and *not* DOI.

LIVE IN COLOUR

How closely were you watching the recent Computer Programme on the BBC? Did you notice the display they used? No . . .well, it was the Low Complexity Colour Display developed by Microvitec.



Available as a desktop 14" screen metal cabinet model, the LCCD — in standard resolution format — offers up to 80 column capability. Other microcomputers with which the LCCD is already compatible include the Apple II and III and machines manufactured by Research Machines, Sharp, Cromemco, Data Applications and Fujitsu.

The 14" metal cabinet LCCD is priced at £279 although Microvitec offer a range of other LCCDs with different specifications (and lower prices!). For further details contact Microvitec Ltd, Futures Way, Bolling Road, Bradford or 'phone them on 0274-390011.

COOL TO THE CORE ▼

If you think your Apple II system is pretty hot stuff then maybe you need to consider one of the functions of the POWER CORE. Combining two functions in one package, the POWER CORE acts as both a cooling system and a switching and filtering system.

As a cooling system, the POWER CORE reduces the internal temperature of the Apple from 47°C to 23°C allowing the computer to work without any fear of a crash due to overheating.

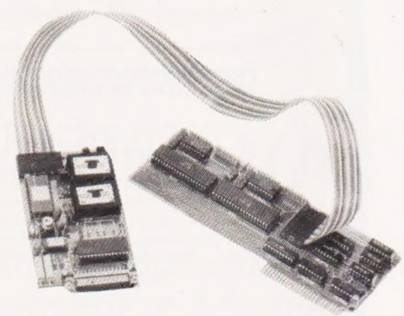
The front panel of the package contains four illuminated switches controlling the switching and filtering operation. These switches control the power supply, the filtered output, the fan and a switch which can be used for a printer or other peripheral devices.

The price of the POWER CORE unit is £149.50 inclusive of VAT and p&p and is available from Avitek, PO Box 14, Twyford, Reading, Berks RG10 0LL. For further details you could always ring 0734-343020.

PICK A CARD

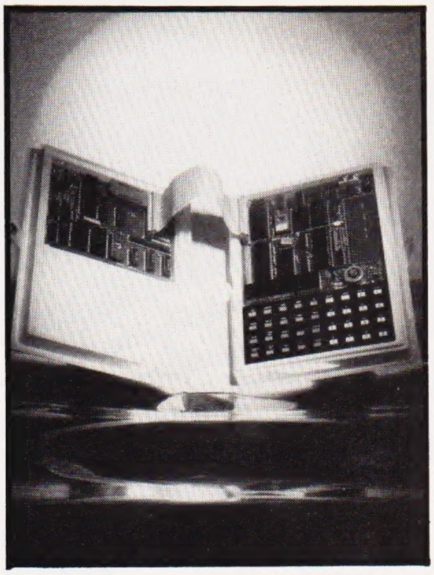
A couple of interface cards have been introduced for the Apple II micro.

The U-A/D is a complete interfacing system in one, offering an eight channel high speed 12-bit A/D convertor, 16 digital I/O lines and timer functions. Complete documentation and example programs are included in the package.



The other card is designated the U-DT and provides 32 digital I/O lines and timer functions. It also incorporates two 6522 VIA chips for versatile operation.

The U-A/D and the U-DT are priced at £250 and £105 respectively. For details of these or the other eight interface cards they manufacture, contact Dr Unsworth at U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR or telephone him on 0925-54117.



ADDING TO THE PROF ▲

If you're an avid reader of CT (and we hope you are), you'll probably remember a fair amount of discussion about the Micro-Professor. At that time a number of add-on options were promised to be available soon. Well, they have arrived!

First up is a speech synthesis board (SSB-MPF), based on the Texas Instruments' voice synthesis processor TMS5200. A TMS2532 memory chip is built into the SSB-MPF for storing a utility program and speech data and there is room for two additional TMS2532 chips allowing up to 150 words to be stored. Also included in the system is a 32K TMS6125 voice synthesis socket for future expansion of the device. The price of this unit, complete with time clock program, mains adaptor, ribbon cable and manual, is £64.95 + VAT.

The other extra is an EPROM programmer board, designated EPB-MPF, which allows the programming capability to read data from EPROM to RAM buffer, to verify EPROM with RAM buffer, to display or modify data on RAM buffer, to re-start the EPB-MPF to its initial state, to write data from the RAM buffer to EPROM, to store data in RAM buffer onto cassette tape and to load data with a cassette recorder. Packaged with keyboard overlay, ribbon cable connectors, power supply and manual, the EPB-MPF is priced at £74.95 + VAT.

For further information get in touch with Flight Electronics Ltd, Flight House, Quayside Road, Bitterne Manor, Southampton, Hampshire S02 4AD or 'phone them on 0703-34003.

NATIONWIDE

The electronic and leisure products chain, Dixons, have decided to market the Commodore VIC 20 colour computer in 250 of their stores throughout the country.

Predicting that by the end of 1985 over one million households will have a home computer, Dixons are hoping they can install a fair share of these by offering the VIC 20 at £199.99.

Dixons have invested over £150,000 into their national press publicity campaign as well as time computer marketing. Still, they'll probably need all the help they can get once the ZX Spectrum and Acorn's Electron start gathering sales!

THE KEY TO SUCCESS

You might have missed this product at the last ZX Microfair (what with the crowds and all) so here's a brief run-down on a new keyboard designed to fit onto the ZX81.

Without the hassle of trailing wires and internal modifications, the keyboard is fitted by peeling off the touch-sensitive keyboard and replacing it with the new one (connectons being made via ribbon cable). The keys are mounted on a PCB finished in matt black and all have a positive 'click' when pressed.

The keyboard is sold as a kit by mail order for £22.50 complete with a set of scaled-down legends to fit onto the keys. To obtain one of these keyboards, send off to Kempston Electronics, 60 Adamson Court, Hillgrounds Road, Kempston, Bedford MK42 8QZ.

BBC NORWICH

No, this isn't about a new TV channel, it's just to tell you about the Norwich & District BBC Microcomputer User Group.

Membership is £2 for 1982, although if you are an old age pensioner or student, membership will only cost £1. For more details, contact Paul Beverley, Room B12a, Norwich City College of Further & Higher Education, Ipswich Road, Norwich, Norfolk NR2 2LJ or telephone him on 0603-60011 extension 233.

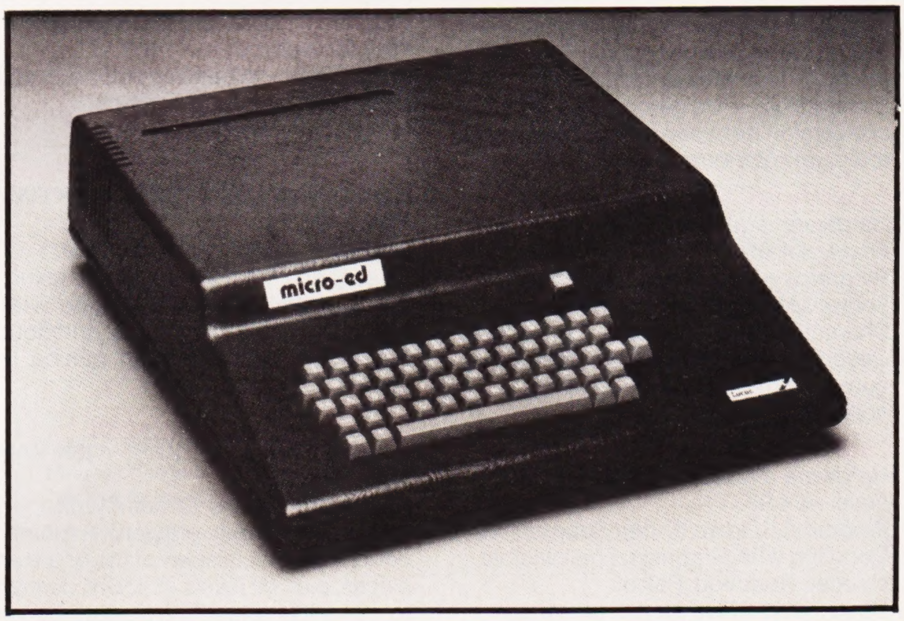
TEACHER'S PET ▼

Using the NASCOM 2 microcomputer in an optimised configuration, the MICRO-ED is an ideal system for use in the classroom environment.

Intended for use as a cassette-based system, the MICRO-ED can also be used in the NAS NET classroom network in DOS mode. Complete with 8K of user RAM, the system has a 57-key solid state keyboard built into the black structural foam plastic case it is housed in.

The MICRO-ED is priced at £399 + VAT but, if you are a full time educational establishment, you can get a very generous discount depending on the quantity you order (discounts vary between 5% and, for orders of 50 units and over, 17.5%).

For more details of the MICRO-ED and the special education offer, get in touch with Lucas Logic Ltd, Nascom Division, Welton Road, Wedgnock Industrial Estate, Warwick CV34 5QZ.



New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

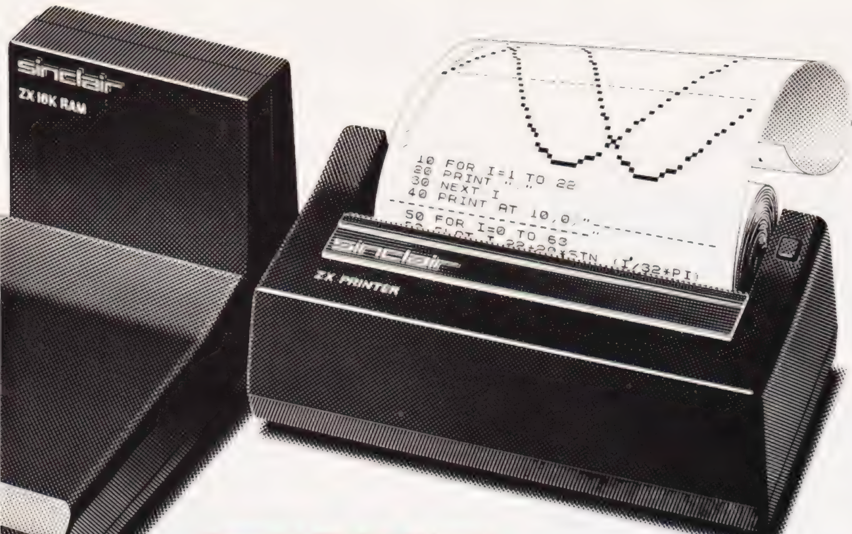
Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Club Record Controller plus blank tape on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Program – VU-CALC.
Description – Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-FILE. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone – simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

sinclair ZX81 SOFTWARE

Sinclair Research Ltd,
Stanhope Road, Camberley, Surrey, GU15 3PS.
Tel: Camberley (0276) 66104 & 21282.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.
Please send me the items I have indicated below.

Qty	Cassette	Code	Item price	Total
	G1: Super Programs 1	30	£4.95	
	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
	G5: Super Programs 5	34	£4.95	
	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
	E2: English Literature 2	45	£6.95	
	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing – *only* if ordering hardware		£2.95	

TOTAL £ ____

I enclose a cheque/postal order to Sinclair Research Ltd for £ ____

Please charge my *Access/Barclaycard/Trustcard no.
**Please delete as applicable.*

Mr/Mrs/Miss

Address

NSA 01

THE SERIES SERIES ▲

Based on the S-100 hardware configuration and utilising a Z80 chip, Almarc are offering five systems within the SERIES-8 range.

The smallest in the range includes a twin floppy device with a total capacity of 1.6M. However, the remaining four machines in the SERIES-8 range are all multi-user systems using Rodime 3,6,9 and 12M hard discs. In the devices using hard disc storage, the design allows for up to four disc units to be added allowing a maximum storage of up to 48M.

The SERIES-8 is offered with tape cartridge back-up and a complete range of dot matrix and letter quality printers. The software supplied with each system is CP/M and MP/M II.

Price for computer systems, including printer and commercial software, will range from £4,000. For further information contact Almarc Data Systems Ltd, Great Freeman Street, Nottingham NG3 1FR or telephone 0602-52657. And while you're talking to them, why not ask them about the Rodime 21M hard disc drive and their new bubble memory option.

A NEW CONCEPT?

Keen Computers Ltd have launched the Corvus Concept, a 16-bit microcomputer designed to operate both as a stand-alone desk-top computer and as a workstation.

The Concept system features memory sizes of up to 512K and can be attached to up to four Corvus hard disc units allowing a storage capacity of up to 80M. Although the Corvus Concept will operate efficiently as a stand-along unit, the design caters for users wishing to create a full Omninet local area network with up to 63 Concepts networked together, each with up to 80M of storage and a wide range of peripherals.

Incorporating two RS232 connections, a clock, two interval timers, a flexible sound generator and speaker and four 50-pin card sockets, the Concept has an efficient operating system, Pascal and FORTRAN compilers and a CP/M emulator.

Keen will be marketing the Concept somewhere around the £3,500-4,000 mark. For further details get in touch with Keen Computers Ltd, 5 Giltspur Street, London EC1 or telephone 01-236 5682.

PRETTY POLY(DOS)

A complete DOS, called PolyDOS, has been designed for the NASCOM 1,2 and 3 microcomputers.

Fully compatible with all existing software written for NAS-SYS 1 or 3, PolyDOS can be installed on any NASCOM with a minimum of 48K RAM and either a GM815 floppy disc system with a Gemini GM809 floppy disc controller card or a Gemini floppy disc system.

Under PolyDOS, the GM815 disc system will support a double sided double density disc giving up to 315K total storage per drive whereas the GM805 system will support only single density format allowing up to 175K per drive. Single density discs are interchangeable between the two systems.

The PolyDOS system includes a 4K disc BASIC extension program, a disc-based editor and an assembler as well as three utility programs. Supplied as a system disc and two 2708 EPROMs, the complete PolyDOS package costs just £90 + VAT and is available from any MicroValue dealer.

For further information get in touch with Gemini Microcomputers Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks HP6 5EQ or by telephone on 02403-28321.

MAMA MIA ▼

Comprising a keyboard, mini floppy disc unit and a separate video display, the Olivetti M20 personal computer is a desk-top machine aimed at the scientific as well as the professional user.

The central unit has a storage capacity ranging from 128-224K, although the floppy disc unit has a capacity of 320K which can be doubled by adding a second disc unit. At a later date it is planned to add a Winchester-type hard disc to the system.

The M20 display can be tilted vertically and horizontally and either black & white or colour screens are available. A special feature of the M20 video display is its ability to be divided up into 16 windows for displaying alphanumeric and graphic information simultaneously.

All system functions are controlled by the Professional Computer Operating System and the M20 can be programmed in BASIC 8000.

Available for £2,400, you can find out more about the M20 personal computer from British Olivetti Ltd, Olivetti House, 86-88 Upper Richmond Road, Putney, London SW15 2UR or by 'phoning 01-785 6666.

BUSINESS NEWS

A COMPUTER A DAY . . . ▸

A British microcomputer, a Z80-based system featuring 64K of RAM, integral dual drives and multiple interfaces, has been launched to appeal to the experienced user in business and education.

Called the Pippen 64 (competition for the Apple, no doubt), the device, complete with CP/M operating system, is being offered to systems houses and computer distributors as the core of a sales package to which they can add further software.

The monitor, disc drives and PSU are all mounted in a self-contained cabinet; the full ASCII keyboard comes as a separate unit. The dual disc drives use double sided double density 5¼" floppy discs and for those requiring additional storage, the facility exists to add another floppy or a Winchester hard disc. An RS232 and Centronics printer interface are standard.

The price of the Pippen 64 is £1,950. Further information can be obtained from Compact Business Machines, Unit 5, Victoria Road, Portslade, Brighton, E Sussex BN4 1XQ or by telephoning 0273-420195.

OKI-DOKEY

Introduced to the market last year, the OKI IF800 micro has been improved for 1982. The standard specification now includes a Centronics standard interface, floppy disc drives with storage capacity of up to 800K and an analogue/digital interface.

The IF800 also contains some new options including the facility to use a digitiser and graph plotter and a light pen as well as connection for a Winchester disc drive allowing the basic system to be expanded up to 10M.

Due to be marketed via computer dealers and shops, the IF800 is priced at £4,300 + VAT. Enquiries should be directed to LSI Computers Ltd, Sherwood Place, St Johns, Woking, Surrey GU21 ISX or by telephone on 04862-23411.

COMPUTER CATALOGUE

Everything you always wanted for your computer but were afraid to order? Now's your chance . . . take a long look at the Willis Computer Supplies catalogue — it's got everything!

Complete with pricing and ordering information, the catalogue includes comprehensive sections on data storage media, all office and computer room furniture and a separate section devoted entirely to cleaning products.

Copies of the catalogue are available from Willis Computer Supplies Ltd, PO Box 10, South Mill Road, Bishop's Stortford, Herts.

MINI TERMINAL ▾

A portable book-size terminal has been launched, ideal for data entry and retrieval around the factory floor, office and retail operations.

Measuring just 2" by 7" by 12", the Transterm One can be used flat on a desk or mounted vertically. Packaged in a rugged casing, the device includes a 64 character alphanumeric display worked through a typewriter format keyboard.

Communicating in full duplex with a V-24/RS232 serial interface, the Transterm One also has an RS422 or 20mA loop option available. A mode switch can select typewriter emulation, block send, multidrop polled or line monitor code.

Priced at around £350, the designers see the unit being used as a portable console terminal and microprocessor support device. For more information on the Transterm One contact Technical Designs, 2 Albone Way, Biggleswade, Bedfordshire SG18 8P[illegible]. Telephone enquiries can be made on 0767-312470.

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FOR THE Z80, TRS-80, ZX81, 380Z

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ORDER INFORMATION

MAGAZINES: Magazine back issues that are not currently in stock are often difficult to obtain. For unavailable and out of print back issues there is a photocopying service at 15p per page plus 30p p/p plus VAT

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Trade Enquiries Welcome

SOFT WARES

GETTING IN ON THE ACT

A totally integrated small business package has been designed for single user floppy disc based systems. There are seven programs in the ISBS-F range of software and all can be seen demonstrated on an ACT Sirius micro at Graffcom's showroom in Holland Park.

The package contains programs for stock control, order entry and invoicing, names and addresses, payroll, company purchases, company sales and general accounting. Each program can be used stand-alone or can be built into an integrated system to user specification.

Supplied with comprehensive reference manuals, the total package is priced at £2,100. For more information contact Graffcom Systems Ltd, 102 Portland Road, Holland Park, London W11 4LX. Telephone enquiries can be made on 01-727 5561.

THE TESTUBE TAPE

A cassette is now available to help you in your quest to pass your GCE/CSE Chemistry exams.

Written for the ZX81 with 16K RAM pack, the cassette includes four programs designed to help students assess their understanding of chemistry; this package is not intended as an introduction to the subject but should correct any misconceptions you may have made.

The programs are based on the assertion/reason questions used by many examining boards; the student will be given pairs of statements to which an indication of whether they are true or false must be made. Programs can be run either in tutorial mode where explanations for wrong answers are given or in the test mode in which a score is given after all the questions have been answered.

For futher information, including details of prices, contact CALPAC Computer Software, 108 Hermitage Wood Crescent, St Johns, Woking, Surrey GU21 1UF.

A MODEL BUSINESS? ▼

Business Modeller is a software package that will address a matrix of 10,000 coordinates allowing a wide range of simple commands to help laying out the worksheet and enter information. It also has numerous built-in functions to facilitate data manipulation and enables the user to create new functions relevant to individual requirement.

Designed for the general manager with no interest in computing, Business Modeller can display a continually updated status check on variable program data or provide help directly related to the operation being performed.

Complete with two program discs, a comprehensive manual, a keyboard mask to identify user defined functions and a pocket-sized card summarizing all the most useful instructions, Business Modeller costs £350.

For further information get in touch with Software Unlimited, Chobham Road, Sunningdale, Berks SL5 0DS or 'phone 0990-21573.

CARD TRICK ▲

Caxton, that somewhat enigmatic software publishing company, have done it again. After the successful launch of their Optimiser linear programming package they have just launched the Cardbox. Written for CP/M based machines, and demonstrated at the launch on Osborne and Advantage micros, it could totally replace the 2500 index cards I've been lumbered with over the last three years.

The product is, to put it simply, totally idiot proof. You can even turn the power off halfway through a job and when you restore the system it will report that you may have lost data and tell you what actions you should take to minimise the loss. That's what I call impressive!

Information stored in the 'electronic' file cards can be formatted in any way you wish and information can be retrieved by a series of data base style interrogations. The program is fully menus driven and many of the commands are compatible with the other popular CP/M based program — Wordstar.

Cardbox is currently being offered at the somewhat conservative price of £155 plus VAT. You can obtain more information directly from Caxton at 10-14 Bedford Street, Covent Garden, London WC2E 9HE or ring on 01-379 6502.

Henry Budgett

Wherever you are in the UK there's a Genie dealer nearby

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ON COURSE

Roger Munford

For those of you who want to become more familiar with computing yet can't seem to fit it into your busy lives, here's a suggestion — why not mix learning with leisure and take a computing holiday? Although the concept of the 'computer holiday camp' has only recently been imported from America, there is already a wide choice of holidays available.

Back To School

The London Computer Summer School, based at Middlesex Polytechnic, are offering five – and seven-day residential or day courses. The courses are aimed at elementary, intermediate and advanced levels to cater for people with little or no previous experience of computing to those already capable with micros who wish to extend their knowledge.

All tuition and practice is given in BASIC as with all of the other holidays. The machine utilised by the School is the VIC-20, with one between every two students. The classes contain no more than 16 students, each taught by one of the School's 25 qualified lecturers with trained assistants available to help with problems. Optional practical workshops and a variety of computers and peripherals are available for further demonstration, comparison and practice.

Although the courses are available to anyone from the age of 13, the younger classes are taught separately to the adults. The School also offers special, less intensive, short courses for children between the ages of 10-12 on a non-residential basis.

The School's programme also includes a range of holiday recreational and sporting facilities.

Computer Campus

For those of you who don't like the idea of a holiday near London, how about a week down at Southampton University? Offering tuition to beginners, enthusiasts, business and professional people, the University's Computer Holiday Camp provides participants with access to a variety of popular micros allowing them to either sit and experiment or take advantage of the workshops and demonstrations available. The machines can be used 24 hours a day!

On particular weeks of this course, specifically designed programs can be provided for common interest groups such as GPs, Policepersons, journalists and secretaries. There is also an experienced Management Consultant available for advice and help, particularly to those running small businesses and the self-employed.

Each student will have his or her own study/bedroom on campus and will be free to enjoy all the sporting and recreational facilities.

Join The Jet Set

The Computer Holiday Week at Bude Holiday Park in North Cornwall from 25th September to 1st October is for computer enthusiasts to share the company of others of a like mind and learn from their experiences.

Your week, organised by Concorde Holidays, will be spent in a modern caravan equipped with all modern conveniences including a VDU! In the main complex there will be room for some 40-60 computers to be set up by individuals to show off their skills. There will also be caravans available for manufacturers and software suppliers who will be able to help and discuss problems.

Included in the Park's amenities are a swimming pool, a shop, two bars, a games room and a dance floor.

In The Swim

The last two holidays on offer are mainly aimed at the younger generation. The first is from Dolphin Camps; an organisation with camps in North London at Mill Hill, in South London at Sevenoaks and in a private estate near Carlisle in the Lake District.

Backed by the Education Unit of the Department of Industry, Dolphin's International Technology Camps have also received generous donations from industry. Indeed, Acorn have provided 40 BBC machines for use at the Sevenoaks camp, Apple have supplied 42 systems to the Mill Hilll camp and the Lake District camp is in proud possession of 42 TI 99/4As from Texas Instruments. All systems are complete with peripheral and software back-up and the camps'experienced supervisors provide close supervision.

Kids Stuff

Last, but not least, are the camps organised by Beaumont Summer Camps for children mostly aged between 10 and 15.

At each of their camps, based at Cheshire, North London, the Lake District, Windsor and Sevenoaks, there will be the opportunity to use about 30 microcomputers. Each camp will also have two or three disc-based sytems available for more complex teaching and applications.

The children who attend these courses need no previous knowledge of computers and require no special aptitude other than a keen interest in computing. The teachers at the camps are polytechnic lecturers or university students, all with considerable knowledge of computing and an interest in teaching children.

Other activities at the Beaumont camps include fencing, football, windsurfing, shooting, dancing, gymnastics and horse-riding.

Have a nice Summer!

London Computer Summer School,
Mortimer House,
37/41 Mortimer Street,
London W1N 7RJ.
01-886 4292
Courses run from July 10—September 11.
Inclusive residential fee is £195.
Inclusive non-residential fee is £149.50.
Non-residential fee for children aged 10-12 is £115.

Computer Holiday Camps,
Dr Lionel Wardle,
Management and Personnel Services,
37 University Road,
Highfield,
Southampton SO2 1TL.
0703-558621
Courses run from July to September.
Self-catering fee is £115.
Part-board fee is £165.

Concorde Holidays,
25 Fore Street,
Praze-An-Beeble,
Camborne,
Cornwall TR14 0JX.
0209-831274
The Computer Holiday Week will run from September 25 — October 1.
The price per caravan for six people is £40-60 + VAT.
For suppliers and manufacturers, caravans are available at £120 which includes accomodation for the whole week.

Dolphin Camps,
8/10 Parkway,
London NW1 7AA.
01-267 6024
01-267 6926 (24 hours)
Holiday weeks run from July 10 — August 28.
Price for each week is £70 although there are some free places available for deserving children.

Beaumont Summer Camps,
100 New Kings Road,
London SW6 6LX.
01-736 3272
Holiday weeks run from July 19 — September 3.
Price for each week is £30.

NEXT MONTH

TOP HOLE!

Well, almost! Next month sees the start of a major new series on advanced software techniques — the skills of Elegant Programming. If you have worked your way through the First Bytes series or tried all the examples in your micro's manual and are looking for something a little more challenging, then this is the place to look.

The series will introduce and expand many of the fundamental rules vital to good programming. It is not simply enough to have a program that runs, the real challenge is to write it more efficiently and with less chance of 'bombs' or other misfortunes.

If you really want to know how programming should be done then the next issue of Computing Today is a must. If you're happy to carry on writing sloppy, inefficient software then . . .

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

THREE DEE

Our Reflections series takes a new twist this month with the introduction of the third dimension. This amazingly compact routine uses mathematical rules to produce 3D wire drawings complete with hidden line removal and, although written for the Apple, is adaptable to any system with line drawing capabilities. So, if you've got a DAI, ATOM, BBC, Compucolor, etc, be the first on your block to make the step to THREE DEE!

MAKE MORE OF IT

Does you micro sometimes just seem to sit and stare at you? Does it beg to be given real work to do for a change? Now, at long last, you can satisfy its cravings. From our next issue we'll be starting a series of features on the mechanics of storing and retrieving information with your computer. The series starts with a look at how to get information onto and off tape — the first step to producing your own data base. This is the Year of Information Technology, why not join in?

THE SOFT CENTRE

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AUGUST ISSUE ON SALE FRIDAY 9th JULY

BASIC ON DISPLAY

Tony Lacy

Watch your Tandy's BASIC at work with this versatile debugging aid. Once used you'll wonder how you ever managed without it!

Many TRS-80 owners, I am sure, are attempting to unravel the secrets of their BASIC interpreter and finding it a most frustrating experience.

There are several aids available which allow us to examine machine code programs: disassemblers, Tandy's own T-BUG and, for disc users, the excellent DEBUG. But they all give a static display. What we really need is a way of examining the flow of information produced as a BASIC program executes.

Obviously it is not going to be much help examining the ROM locations as they won't change but there is an area of RAM called the scratchpad which holds temporary variables and other vital information. If we can observe this as a program runs we can gain a few clues about the operation of the interpreter.

In addition, this program also demonstrates a way of extending BASIC by adding new commands. Using more sophisticated examples of the method shown here you will be able to create your own Level N BASIC.

Getting It Running

At this stage we must assume that you have a Level 2 BASIC, although some modifications for disc BASIC use will be given later.

The first operation is to generate the object program, either by typing in the source code as illustrated with an editor/assembler or by using T-BUG's M function to enter the Hex code. Note that if you use the latter method, it will not be easy to relocate the program and several jump addresses will have to be altered.

One point to note about the asssembler used to generate the source listing is that it does not print out the ASCII strings generated by the DEFM pseudo-operation at lines 1940 and 1950. These have been inserted by hand during the setting of the program.

Your next task is to make a system tape; the entry point is the start address (INIT in the source listing). If you are using T-BUG, the command will be of the form:

```
P BEØØ BF42 BEØØ NAMEIT
```

Now Reset the machine, specify the appropriate MEM SIZE and load the program under SYSTEM. Press '/' then 'Enter' and the READY prompt should appear. You can now carry on as normal; at this stage I would suggest that you load a small BASIC program which loops continuously to try out the new command.

To initialise the command, type:

```
PRINT &BUG,XXXX
```

where XXXX is any valid Hex address. The program performs its own syntax checks and will return an error if the address was incorrect. Note that disc users will find execution drops through to the normal &HXXXX processing and may return an error message from there.

If you RUN your BASIC program, the top line of the screen display will fill with various numbers. These are the displays of the various scratchpad registers and will be explained later. This display is independent of the BASIC program and does not affect scrolling or cursor postioning in any way.

Your now have access to a number of sub-commands which will be explained in the next section. It is also worth noting that when running in a display mode, the &BUG program slows down program operation and care will be needed when carrying out time-dependent operations such as CLOAD or CSAVE.

To turn off the display, and to remove the delays at the same time, press the C and D keys together (Clear Display). If you wish to reactivate &BUG simply repeat the intialise command above.

The &BUG Sub-commands

The program gives the user an extra four commands which are activated by pressing pairs of keys.

DElay	Press D and E. Inserts an extra delay to make viewing easier.
Cancel Display	Press C and D. Returns to normal operation as explained above.
ReSet mode	Press R and S. Removes the delay and the single step feature but retains the display.

STep Press S and T. Puts the BASIC program into single-step mode, the Shift key controlling the program operation.

The single-step feature can give some puzzling results and therefore requires some explanation. Unlike the PAUSE operation built into BASIC, it actually halts the program; the only operation that continues is the interrrupt servicing for Disc BASIC. While &BUG is waiting for the Shift key to be pressed it will not respond to any other sub-commands. Further to this, it is possible for &BUG to be entered several times while executing a single BASIC statement and this may give the appearance that nothing is happening; the reasons for this will become clear as you read the next section!

A New Command

The secret of adding new commands lies in the concept of 'jump vectors'. The designers who wrote the original TRS-80 software were very much aware that a certain amount of flexibility would be required for future expansion (Disc BASIC for example) yet the programs they were writing were to be frozen in ROM. The answer is to jump out of ROM at certain strategic points which gives us the opportunity to divert the program flow.

These jumps can be set up in RAM when the machine is powered up and can then be changed to suit our purposes. There are several areas used, that between 4152 and 41A3 Hex contains the jump-backs for the Disc BASIC reserved words and gives an 'L3 ERROR' if called from Level 2 BASIC. The jump that has been chosen resides at 4194 Hex and now responds to the reserved word '&' providing the jump to the &BUG program. The original jump is stored and is used if &BUG is not in operation or there is a Syntax Error so that the computer can carry on as though nothing has happened while still giving the correct error message. This part of the program also obtains and stores the address of the section of memory we want displayed.

The next requirement for a dynamic display is to break into the sequence of operations at a frequently used point. The area between 4000 and 4012 Hex contains the jump vectors for the RST instructions and is the most suitable point. These RST instructions operate like

```
4124=> 8A F0 FF FF FF FF FF FF FF FF FF FF 20 20 20 20  <@65535>

MEM SIZE PROTECTED YOUR HEX PROGRAM?

4 BYTE ADDRESSES PLEASE

START ADDRESS (HEX) ?
BREAK IN 40
READY
>?&BUG,4124
READY
>
>_
```

Fig. 1. How the screen looks when &BUG is running.

subroutine calls except that they are to certain fixed locations and, unlike a normal CALL, they only take a single byte of memory. There are eight RST's for the Z80 and they cause jumps to addresses between 0 and 38 Hex. Each RST is usually labelled with the address that it calls, RST 10 for example (the opcode for this would be D7 instead of the CD 10 00 required for a CALL). If you look at the contents of location 10 Hex you find a jump to 4003 Hex; once again the jump vector idea is being used with the byte-saving RST employed in ROM to call an address in RAM.

The RSTs will be reserved for the most commonly used subroutines and the vectors associated with them are suitable candidates for inspecting the operation of the interpreter. Indeed, the RST 10 instruction is often called several times during the course of a single statement, hence the apparent anomoly with the single-step function. Since the RST calls are so fundamental to the operation of the program, it is essential to save the original vector and jump there when we exit from whatever program we have inserted.

The new command link works in the following way:

1. To initialise, re-vector reserved word '&'.
2. To activate, re-vector RST 10 and save original jump.
3. To de-activate, restore original RST 10 jump.
4. The '&' jump vector remains in place.

&BUG's Display Format

The diagram shown in Fig. 1 shows the general layout of the display. The first four Hex digits indicate the address of the first byte following the '=>' symbol; this should be the one you selected using the PRINT &BUG, XXXX command. The next 16 Hex values are the contents of the next 16 addresses.

The character following the '<' symbol is a mode indicator and has the following states:

@	Normal display mode.
D	Extra delay mode.
S	Single-step mode.
W	D and S combined.

The next group of decimal digits is the current line number of the BASIC program being executed or 655365 if in command mode. This duplicates the TRON function of BASIC except that the line number stays in one place instead of wiping out your program results.

The display ends with a '>'.

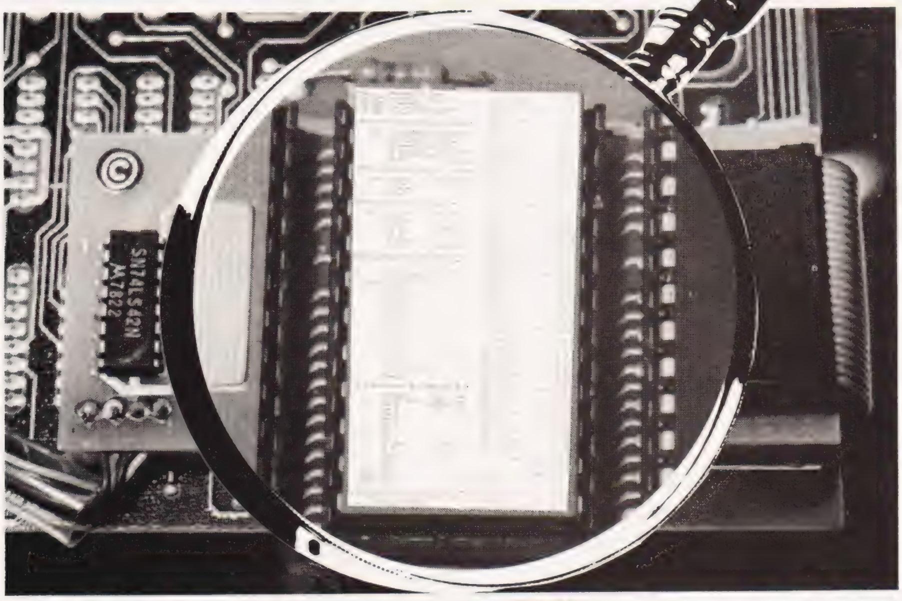
Program Stucture

Breaking the program down into its main sections for the purposes of explanation we get:

INIT This section runs just once and its purpose is to divert the jump at 4194 Hex to the start of the new command and saves the original jump address.

When patching in new programs, it is often a good idea to re-

BASIC ON DISPLAY



The utility will give you a 'close-up' view of your BASIC!

tain the original jump on exit rather than assuming that you know what it should be. This ensures that any existing patches which you may not be aware of will not be disturbed — Tandy software writers, please take note! The jump to 06CC Hex avoids the annoying OM ERROR when returning to BASIC via 1A19 Hex but otherwise achieves the same result.

ENTRY This is where execution will now go when the '&' statement is encountered; at this point in the proceedings the HL register pair will point to the '&' in the program text. This position must be saved in case the syntax check shows that &BUG has not been invoked so that the normal error processing can occur. RST 10 is used next in its normal role, that of incrementing the HL register pointer to the next non-space character.

SN This section compares the next four characters with the characters stored in MESS to see if they are 'BUG,'. If they are not, the HL register contents are restored and execution continues as if nothing had happened.

If the characters do match the MESS, the next four characters are checked to see if they are valid Hex digits. If not, the BASIC program continues, otherwise they are stored in two forms: once for display on the screen as ASCII characters and once as binary for the program to make use of later. The conversion from ASCII Hex to binary is performed by the routines ASCHEX and HEX.

The next operation is to divert the jump associated with RST 10; when this is achieved we will return to the command mode. What, you may be wondering, is the purpose of those POPs? After all, only one POP should be needed to 'balance' the equation and, furthermore, what is that NOP doing?

To explain this, a short digression is required but it does serve to show why, when you are trying to untangle those ROM routines, you often seem to end up in the land of never-never.

RETURNs That Don't

The machine code RET instruction is usually regarded as the equivalent of a RETURN in BASIC and is most often used in this way. However, in many parts of the interpreter, it is used somewhat differently. The actual mechanism of the RET instruction is to take the value which the stack pointer is pointing to and place this in the program counter—the stack pointer is then incremented.

If this value happens to be the calling address then the program will continue from this address (this is the way that subroutines are implemented from machine code).

There are, however, other instructions, such as PUSH which uses the stack area, and some of the 16-bit registers which can be exchanged with the stack pointer. The point is that the RET doesn't always get us back to the calling location. When BASIC processes a statement, a part of the interpreter loads the stack area with a series of addresses which represent a route map through the interpreter and the program is steered by a sequence of RET instructions. These must be treated as jumps and as each one is executed, the next one is pointed to by the stack pointer. Execution usually ends up at 1DE1 Hex and this will be found somewhere at the top of the stack area; the procedure is further complicated by the fact that all conventional calls and returns, as well as POPs and PUSHes, are taking place at the same time.

When the BASIC program text '&BUG,' is encountered, the interpreter makes certain assumptions about the statement '&' and sets up the stack area ready for the journey through ROM. We, however, want an immediate return to BASIC command mode on successful exit from this section of the program. So, we simply do a series of dummy POPs until the address 1DE1 Hex appears at the return point and then do a RET.

You will have deduced from the above that when you see a RET instruction in ROM, the place that the program branches to could have been determined many instructions ago and is hidden somewhere in the stack area.

Now, what about the NOP? Well, when the program was originally assembled and debugged, I inserted several NOPs to provide a breathing space in case things needed to be moved around. The one that remains is a relic from this stage of the development which simply got left behind — well, we're only human!

The rest of the program is very simple. Since RST 10 is called from various areas, all of the used registers are saved to make the display section transparent to normal operation. The only effect is the delay caused by the time taken to run through the various checks.

The Rest Of It

The remaining sections of the program are as follows:

BUG This section finds which bit of memory is to be displayed, converts the contents into ASCII form and puts them onto the screen.

LINE NUMBER TRACE This gets the display mode onto the screen and then displays the contents of address 40A2 Hex which happens to be the current line number. The conversion required this time is to decimal ASCII.

Program Listing

```
        LENGTH EQU 16     Memdump line length
        AMPERS EQU 4194   &--Existing jump vector
        SCR    EQU 3CØØ   Screenstart
        RST 1Ø EQU 4ØØ4   RST 1Ø--Existing vector
        LINHEX EQU 4ØA2   Current line no here

      ** THIS SECTION EXECUTED ONCE ONLY AFTER LOAD **

BEØØ 2A 95 41      INIT   LD HL,(AMPERS+1) Get existing
BEØ3 22 6A BE             LD (SAVED+1),HL  Save it
BEØ6 21 15 BE             LD HL,ENTRY      Get new
BEØ9 22 95 41             LD (AMPERS+1),HL Install it
BEØC 2A Ø4 4Ø             LD HL,(RST 1Ø)   Get existing
BEOF 22 1E BF             LD (VECTOR+1),HL Save it
BE12 C3 CC Ø6             JP Ø6CC          Avoids OM ERR

     ** THIS SECTION EXECUTED WHEN '&BUG,----' FOUND **

BE15 E5            ENTRY  PUSH HL          Save for EREX
BE16 D7                   RST 1Ø
BE17 11 34 BF             LD DE,MESS
BE1A Ø6 Ø4                LD B,4

         ** SYNTAX CHECK OF TEXT:-'&BUG,XXXX' **

BE1C 7E            SN     LD A,(HL)        Get text chr
BE1D 4F                   LD C,A
BE1E 1A                   LD A,(DE)
BE1F 91                   SUB C            Compare it
BE2Ø 23                   INC HL           Try next
BE21 13                   INC DE
BE22 2Ø 44                JR NZ,ERROR      Not same
BE24 1Ø F6                DJNZ SN          Try again

      ** GET MEMORY DISPLAY REQUEST INTO MEMORY IN **
       ** BOTH ASCII AND HEX FORMS FOR USE LATER **

BE26 Ø6 Ø2                LD B,2           Do it twice
BE28 DD 21 2D BF          LD IX,ASCMEM     For ASCII
BE2C 11 2C BF             LD DE,MEMHEX+1   For Hex
BE2F 7E            ASCHEX LD A,(HL)
BE3Ø DD 77 ØØ             LD (IX),A
BE33 CD 5B BE             CALL HEX
BE36 87                   ADD A,A
BE37 87                   ADD A,A
BE38 87                   ADD A,A
BE39 87                   ADD A,A
BE3A 4F                   ADD C,A
BE3B 23                   INC HL
BE3C DD 23                INC IX
BE3E 7E                   LD A,(HL)
BE3F DD 77 ØØ             LD (IX),A
BE42 CD 5B BE             CALL HEX
BE45 B1                   OR C
BE46 12                   LD (DE),A
BE47 1B                   DEC DE
BE48 DD 23                INC IX
BE4A 23                   INC HL
BE4B 1Ø E2                DJNZ ASCHEX
BE4D E5                   PUSH HL

     ** SYNTAX OK SO REVECTOR RST 1Ø TO TURN &BUG ON **

BE4E 21 6C BE             LD HL,BUG        Start of BUG
BE51 22 Ø4 4Ø             LD (RST 1Ø),HL   Install new
BE54 E1                   POP HL           Restore text
BE55 C1                   POP BC
BE56 C1                   POP BC
BE57 C1                   POP BC
BE58 C1                   POP BC
BE59 ØØ                   NOP
BE5A C9                   RET
BE5B D6 3Ø         HEX    SUB 3Ø
BE5D 38 Ø8                JR C,EREX        < 3Ø Hex?
BE5F FE ØA                CP ØA            > 1Ø?
BE61 D8                   RET C
BE62 D6 Ø7                SUB 7
BE64 FE 1Ø                CP 1Ø            >15?
BE66 D8                   RET C
BE67 C1            EREX   POP BC
BE68 E1            ERROR  POP HL
BE69 C3 ØØ ØØ      SAVED  JP Ø

     ** THIS IS THE PROGRAM PROPER. IT IS EXECUTED **
       ** EVERY TIME AN RST 1Ø IS USED BY BASIC **
                  ** (WHEN ACTIVE). **
               ** MEMORY DUMP SECTION **

BE6C E5            BUG    PUSH HL
BE6D D5                   PUSH DE          Save register
BE6E C5                   PUSH BC          to ensure
BE6F F5                   PUSH AF          transparency
BE7Ø DD E5                PUSH IX
BE72 21 2D BF             LD HL,ASCMEM
BE75 11 ØØ 3C             LD DE,SCR
BE78 Ø1 Ø7 ØØ             LD BC,7
BE7B ED BØ                LDIR
BE7D 2A 2B BF             LD HL,(MEMHEX)
BE8Ø Ø6 1Ø                LD B,LENGTH
BE82 7E            LOOP1  LD A,(HL)
BE83 F5                   PUSH AF
BE84 CB 3F                SRL A
BE86 CB 3F                SRL A
BE88 CB 3F                SRL A
BE8A CB 3F                SRL A
BE8C CD 2Ø BF             CALL CONV        Convert Hex
BE8F F1                   POP AF           into ASCII
BE9Ø E6 ØF                AND ØF           Hex
BE92 CD 2Ø BF             CALL CONV
BE95 23                   INC HL
BE96 3E 2Ø                LD A,2Ø
BE98 12                   LD (DE),A
BE99 13                   INC DE
BE9A 1Ø E6                DJNZ LOOP1

             ** LINE NUMBER TRACE SECTION **

BE9C 3E 3C                LD A,'<'
BE9E 12                   LD (DE),A        Display it
BE9F 13                   INC DE
BEAØ 3A 38 BF             LD A,(MODE)
BEA3 12                   LD (DE),A
BEA4 13                   INC DE
BEA5 2A A2 4Ø             LD HL,(LINHEX)
BEA8 DD 21 39 BF          LD IX,TABLE
BEAC DD 4E ØØ      LOOP2  LD C,(IX+Ø)
BEAF DD 46 Ø1             LD B,(IX+1)
BEB2 3E 2F                LD A,2F
BEB4 B7                   OR A
BEB5 3C            LOOP3  INC A
BEB6 ED 42                SBC HL,BC
BEB8 3Ø FB                JR NC,LOOP3
BEBA Ø9                   ADD HL,BC
BEBB 12                   LD (DE),A
BEBC ØD                   DEC C
BEBD 13                   INC DE
BEBE 28 Ø6                JR NZ,DUN
BECO DD 23                INC IX
BEC2 DD 23                INX IX
BEC4 18 E6                JR LOOP2
BEC6 3E 3E         DUN    LD A,'>'
BEC8 12                   LD (DE),A

  ** THIS SECTION SCANS THE KBD FOR A MODE CHANGE **

BEC9 3A Ø1 38             LD A,(38Ø1)
BECC FE 18                CP 18
BECE 28 25                JR Z,CANCEL
BEDØ FE 3Ø                CP 3Ø            D and E?
BED2 2Ø Ø8                JR NZ,SSTEP
BED4 3A 38 BF             LD A,(MODE)
BED7 F6 44                OR 'D'
BED9 32 38 BF             LD (MODE),A
BEDC 3A Ø4 38      SSTEP  LD A,(38Ø4)
BEDF FE 18                CP 18            S and T?
BEE1 2Ø Ø8                JR NZ,RESET
BEE3 3A 38 BF             LD A,(MODE)
BEE6 F6 53                OR 'S'
BEE8 32 38 BF             LD (MODE),A
BEEB FE ØC         RESET  CP ØC            R and S?
BEED 2Ø ØE                JR NZ,DUMP
BEEF AF                   XOR A
BEFØ 32 38 BF             LD (MODE),A
BEF3 18 22                JR CARYON
BEF5 2A 1E BF      CANCEL LD HL,(VECTOR+1) Restore old
BEF8 22 Ø4 4Ø             LD (RST 1Ø),HL   vector then
BEFB 18 1A                JR CARYON        exit

          ** THIS SEGMENT FINDS DISPLAY MODE **
                 ** AND EXECUTES IT **

BEFD 3A 38 BF      DUMP   LD A,(MODE)      Find mode
BFØØ B7                   OR A             Reset mode?
BFØ1 28 14                JR Z,CARYON
BFØ3 FE 53                CP 53
BFØ5 28 Ø8                JR Z,WAIT
BFØ7 Ø1 ØØ 2Ø      DELAY  LD BC,2ØØØ
BFØA F5                   PUSH AF
BFØB CD 6Ø ØØ             CALL 6Ø
```

```
BF0E F1                   POP AF
BF0F 38 06        WAIT    JR C,CARYON
BF11 3A 80 38     STEP    LD A,(3880)
BF14 B7                   OR A
BF15 28 FA                JR Z,STEP
BF17 DD E1        CARYON  POP IX
BF19 F1                   POP AF
BF1A C1                   POP BC
BF1B D1                   POP DE
BF1C E1                   POP HL
BF1D C3 00 00     VECTOR  JP 0
BF20 C6 30        CONV    ADD A,30
BF22 FE 3A                CP 3A
BF24 38 02                JR C,VID
BF26 C6 07                ADD A,7
BF28 12           VID     LD (DE),A
BF29 13                   INC DE
BF2A C9                   RET
BF2B 00 00        MEMHEX  DEFW 0
BF2D 00 00        ASCMEM  DEFW 0
BF2F 00 00                DEFW 0
BF31 3D 3E 20             DEFM '=> '
BF34 42 55 47 2C  MESS    DEFM 'BUG,'
BF38 00           MODE    DEFB 0
BF39 10 27        TABLE   DEFW 10000
BF3B E8 03                DEFW 1000
BF3D 64 00                DEFW 100
BF3F 0A 00                DEFW 10
BF41 01 00                DEFW 1
```

KEYBOARD SCAN The keyboard is treated as a group of memory locations and key presses alter the contents of these locations. The values from this scan are used to set a mode flag at MODE or to cancel the operation of the program.

DUMP, DELAY and STEP Each of these sections is only a few bytes long and the comments in the source listing should be adequate.

CARYON The registers are restored and control is returned to BASIC via the jump vector which was originally at 4004 Hex.

Where From Here

It is probably worth suggesting a couple of areas of general interest which can be looked at while a BASIC program RUNning. The area of RAM between 4041 and 4130 Hex is particularly interesting, with temporary variables being stored around 4121 Hex. You will find other addresses with values relating to line number, cursor position, etc and many of these will be changing as you watch.

Another interesting area is the stack. This will be in high memory, somewhere below the reserved memory area. As I indicated above, this is also an area of continual change. Program variables can be found just above the BASIC program itself; in fact, a few modifications to &BUG would allow display of BASIC variable values in decimal as a program is run.

Disc BASIC Usage

Users of Disc BASIC will have to do a little work here I'm afraid — there are some snags. First, the jump in INIT to 06CC Hex will have to be changed to 402D Hex, but that is the least of your problems.

The jump to 4194 Hex is not used by DOS so in its present form, &BUG will only operate from BASIC.

You can save the object code as a CMD file which will load and initialise normally but when you enter BASIC from DOS, not forgetting to set the memory size, the jump vector at 4195 Hex will be reset. You can either find a way round this problem or simply POKE the values back in from BASIC.

Owners of NEWDOS can use CMD"FILESPEC" to load the program while in BASIC but they will also find the jump vector reset on return to BASIC. If anyone has discovered a way round this problem I would be delighted to know!

BOMB RUN

Flying your 'plane is easy... but landing?

A Crosland

This program occupies less than 1K of RAM and will run on an unexpanded NASCOM 1 under the NAS-SYS 1 monitor. The program will also run under other monitors or even in different (Z80) systems with a few alterations. A few notes are given later to aid those who wish to make such alterations to the program.

To play the game, the program should be executed from 0C80 Hex by using the monitor 'E' command. The subsequent display consists of a graphical representation of an aeroplane which starts in the top left hand corner and moves across and down the screen, and a pattern of white blocks at the bottom of the screen representing buildings. The object of the game is to destroy the buildings, by dropping bombs from the plane, in order to clear a landing place for the plane. Bombs are dropped from the plane by pressing any key on the keyboard, but you may only have one bomb in the air at any one time (otherwise the game would be too easy). The strength of each bomb is decided by randomly generating a stream of pseudo-random numbers.

A point is scored for every block destroyed and the total is displayed on the top line of the screen. If you manage to completely destroy the buildings then the game will restart and progress at a faster pace in which case the points total will be carried over between games. If you fail however, the program will ask you if you wish to continue playing the game; 'N' will clear the screen and return control to NAS-SYS, 'Y' will give you another try.

Program Alterations

The following notes should be of help to those of you wishing to modify the program in order to allow it to run under monitors other than NAS-SYS 1.

The NAS-SYS monitor uses the Z80 restart instructions for calling all its subroutines. These will have to be replaced by CALL instructions for most other monitors. Three of the routines (PRS, RDEL, and RIN) used in this program are called using a specific restart for each one; the other three monitor routines are each called by putting the code DFH (RST 18 Hex) in the program followed by the number of the routine to be called. The routines used by the program are described below. If any of these are replaced by CALL instructions then some other parts of the program will need relocating to fit in the extra bytes. The displacements for the relative jumps will also need re-calculating.

Code	Routine	Function
EF	PRS	Print the following ASCII codes until 00 Hex is found.
CF	RIN	Input character in accumulator.
FF	RDEL	Delay for approximately 5 mS @ 2 MHz.
DF 62	IN	Scan keyboard; if key pressed then return with character in the Acc and set carry flag else return with carry reset.
DF 7C	CPOS	Return with position of first character on the line (pointed to by the cursor) in HL.
DF 5D	TDEL	Delay for approximately 2 sec @ 2 MHz.

Address 0C29 Hex is used by NAS-SYS to hold the cusor address; this will need to be altered to suit the monitor being used. This of course means that the game can only be played on systems which have a memory-mapped display.

The section of code between 0DD Hex and 0DE8 Hex is used to give the NASCOM keyboard a 'repeat' effect. If your keyboard has auto repeat then the corresponding section of code will not be needed in your system. The only other point which may need some explanation is the random number generator. The method employed is to simulate a feedback shift-register in software (this is done between 0D86 Hex and 0D8F Hex). The seed for the generator, set at the beginning of the game, is held at address 0F02 Hex; any number other than zero may be used.

The section of memory from 0CA3 Hex to 0D61 is used to store the pattern for the buildings. A detailed copy is not included in the program listing as it would take up quite a large amount of space, however, it is very easy to design your own pattern in the following manner. The first 48 bytes represent the third line up from the bottom of the screen, the next 48 the second line up, the next 48 the first line up and the remaining bytes represent the bottom line of the screen. Where you require a block to appear on the screen the value 7F Hex should be included in the relevant position in memory; for an empty space in the code 20 Hex should be used. As an example, if you want a tower to appear at the left-hand edge of the screen, a 7F Hex should be placed at addresses 0CA3 Hex, 0CD3 Hex, 0D03 Hex and 0D33 Hex. Those of you who are observant will have noticed by now that the bottom right-hand location cannot be defined in this way, this is deliberate and is to guard against accidental scrolling (this location is not visible on many TVs anyway). All there is left to say now is . . . happy bombing!

Photograph courtesy of THORN EMI Video Programmes Ltd.

Program Listing

```
0C80   EF   0C   00          START   RST PRS,'CS'
0C83   21   32   0E                  LD HL,MESS1
0C86   11   DD   0B                  LD DE,0BDDH
0C89   01   06   00                  LD BC,0006H
0C8C   ED   B0                       LDIR
0C8E   EB                            EX DE,HL
0C8F   06   03                       LD B,03H
0C91   23                    CLRPNT  INC HL
0C92   36   30                       LD (HL),20H
0C94   10   FB                       DJNZ CLRPNT
0C96   21   76   0D                  LD HL,DELAY
0C99   36   10                       LD (HL),10H
0C9B   21   CA   0A                  LD HL,0ACAH
0C9E   22   29   0C                  LD (CURSOR),HL
0CA1   00                            NOP
0CA2   EF                            RST PRS
0CA3   )
  :    )  SEE TEXT
0D61   )
0D62   00                            DEFB 00H
0D63   21   0A   08                  LD HL,080AH
0D66   22   29   0C                  LD (CURSOR),HL
0D69   21   00   00                  LD HL,0000H
0D6C   EF                    MOVE    RST PRS
0D6D   11   11   11   20             DEFS'CL CL CL SP'
0D71   2D   2D   09   00             DEFS '--',00H
0D75   06                            DEFB 06H
0D76                         DELAY   DEFS1
0D77   FF                    DEL1    RST RDEL
0D78   10   FD                       DJNZ DEL1
0D7A   DF   62                       RST SCAL,DEFB IN
0D7C   30   1B                       JRNC,LAND?
0D7E   7C                            1D A,H
0D7F   B5                            OR L
0D80   20   17                       JRNZ,LAND?
0D82   2A   29   00                  LD HL,(CURSOR)
0D85   00                            NOP
0D86   3A   02   0F                  LDA,(SEED)
0D89   CB   27                       SLA A
0D8B   30   02                       JRNC,NOC
0D8D   EE   1D                       XOR 1DH
0D8F   32   02   0F          NOC     LD (SEED),A
0D92   E6   C0                       AND C0H
0D94   07                            RLC A
0D95   07                            RLC A
0D96   C6   01                       ADD A,01H
0D98   4F                            LD C,A
0D99   E5                    LAND?   PUSH HL
0D9A   2A   29   0C                  LD HL,(CURSOR)
0D9D   11   B6   0B                  LD DE,0BB6H
0D0A   ED   52                       SBC HL,DE
0D02   E1                            POP HL
0D03   30   7A                       JR NC,LANDED
0D05   7C                            LD A,H
0D06   B5                            OR L
0D07   28   40                       JRZ,MOVE1
0D09   36   20                       LD (HL),20H
0D0B   11   40   00                  LD DE,0040H
0D0E   19                            ADD HL,DE
0D0F   E5                            PUSH HL
0DB0   DF   7C                       RST SCAL,DEFB
                                     CPOS
0DB2   11   C0   0B                  LD DE,OBCOH
0DB5   ED   52                       SBC HL,DE
0DB7   E1                            POP HL
0DB8   30   20                       JRNC,NOBOMB
```

```
0DBA   7E                                     LD A,(HL)
0DBB   FE   20H                               CP 20H
0DBD   36   2E                                LD (HL),2EH
0DBF   28   28                                JRZ,MOVE1
0DC1   06   03                                LD B,03H
0DC3   E5                                     PUSH HL
0DC4   21   E7   0B                           LD HL,0BE7H
0DC7   2B                             INC     DEC HL
0DC8   7E                                     LD A,(HL)
0DC9   FE   39                                CP 39H
0DCB   20   06                                JRNZ,INC1
0DCD   36   30                                LD (HL),30H
0DCF   10   F6                                DJNZ INC
0DD1   18   01                                JR TSTBMB
0DD3   34                             INC1    INC (HL)
0DD4   E1                             TSTBMB  POP HL
0DD5   0D                                     DEC C
0DD6   20   11                                JRNZ,MOVE1
0DD8   36   20                                LD (HL),20H
0DDA   21   00   00                           LD HL,0000H
0DDD   E5                                     PUSH HL
0DDE   21   01   0C                           LD HL,0C01H
0DE1   06   09                                LD B,09H
0DE3   36   00                        CLRKEY  LD (HL),00H
0DE5   23                                     INC HL
0DE6   10   FB                                DJNZ,CLRKEY
0DE8   E1                                     POP HL
0DE9   ED   5B   29   0C              MOVE1   LD DE,(CURSOR)
0DED   1A                                     LD A,(DE)
0DEE   FE   7F                                CP 7FH
0DF0   C2   6C   0D                           JPNZ,MOVE
0DF3   00                                     NOP
0DF4   00                                     NOP
0DF5   DF   5D                                RST SCAL,DEFB
                                              TDEL
0DF7   EF   0C   00                           RST PRS,'CS'
0DFA   21   38   0E                           LD HL,MESS2
0DFD   11   5B   09                           LD DE,095BH
0E00   01   0A   00                           LD BC,000AH
0E03   ED   B0                                LDIR
0E05   21   42   0E                           LD HL,MESS3
0E08   11   9A   09                           LD DE,099AH
0E0B   01   0C   00                           LD BC,000CH
0E0E   ED   B0                                LDIR
0E10   CF                             INPUT   RST RIN
0E11   FE   59                                CP 'Y'
0E13   CA   80   0C                           JPZ,START
0E16   FE   4E                                CP 'N'
0E18   20   F6                                JRNZ,INPUT
0E1A   EF   0C   00                           RST PRS,'CS'
0E1D   DF   5B                                RST MRET
0E1F   21   76   0D               LANDED      LD HL,DELAY
0E22   3E   FE                                LD A,FEH
0E24   86                                     ADD A,(HL)
0E25   20   02                                JRNZ,STORE
0E27   3E   02                                LDA 02H
0E29   77                             STORE   LD (HL),A
0E2A   EF                                     RST PRS
0E2B   08   08   08   00                      DEFS 'BS BS BS'
                                              00H
0E2F   C3   98   0C                           JP 0C9B
0E32   50   4F   49   4E   54   53            DEFS 'POINTS'
0E38   48 41 52 44 20 4C 55 43 4B 21          DEFS 'HARD LUCK
0E42   41   4E   4F   54   48   45   52       DEFS 'ANOTHER
       20   54   52   59   3F                 TRY?'
```

Jeremy Ruston

Could this be the hand-held computer that all the rest try to follow? It certainly is an exceptionally powerful package as our reviewer explains.

If you ever thought that the PC-1211 was an impressive little piece of machinery then the latest offering from Sharp, the PC-1500, is a whole new experience.

Weighing in at a mere 13 ounces — that's about the same as 1½ copies of this magazine — the PC-1500 is slightly bigger than its predecessor measuring 195mm by 86mm by 25mm (the extra weight is certainly helpful when using it on a table top). Just like the PC-1211, a typewriter-style keyboard is featured but on the PC-15000, the keys are even closer in spacing to the real thing. The usual top row of numeric keys is missing, a numeric keypad being located on the right instead. This keypad also includes the usual arithmetic function keys and some punctuation symbols. Unfortunately, symbols such as commas, colons and semi-colons are only accessible through the Shift key which operates as on the PC-1211: Shift then key. However, as you can define several of the other keys on the keyboard to perform different functions, you can easily get around this if you wish.

Various other symbols are dotted around the keyboard and these include a square root and pi sign as well as the cursor controls which double up as editing keys. All the keys have the feel of a good quality calculator but you certainly won't win any prizes for speed typing as the computer simply cannot keep up. However, this is no real disadvantage since, although Sharp mention wordprocessing in their documentation, it is a little far-fetched. I would still rather use the PC- 1500 keyboard than that on my ZX81 though!

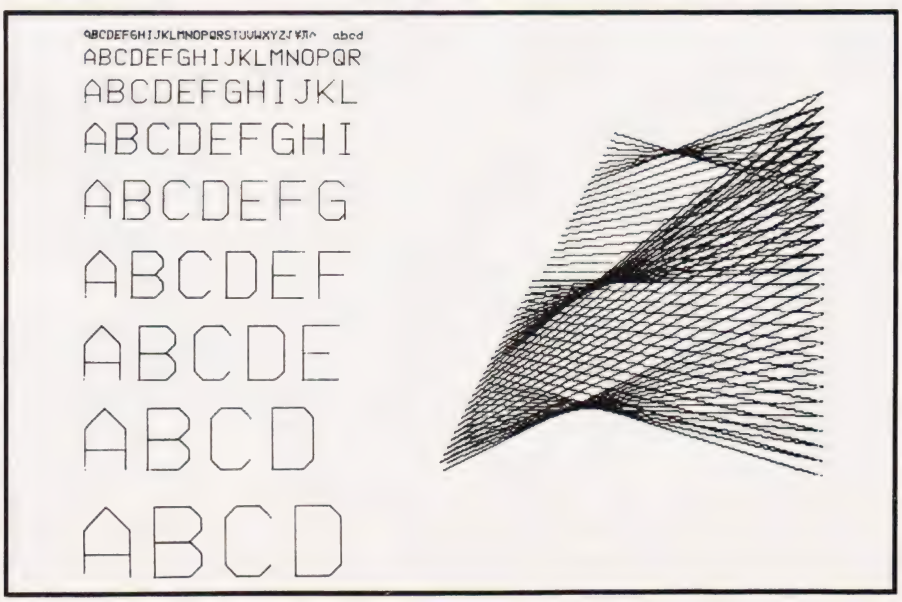
On Display

The LCD display strip shows 26 characters at a time and the total line length can be up to 80 characters, based on a 5 by 7 matrix. As an improvement over the PC-1211, the new machine offers lower case, without descenders, and most of the ASCII set is made available. One or two of the characters have been re-allocated, for example, code 39 is used as a special editing symbol instead of the usual apostrophe. The editor inserts this character every time you 'insert'; if any are left unused when you Enter the line, the system automatically deletes them — simple but an example of the thought that has been put into the machine. The only truly irritating character is the lower case 'L' which shows up as a single vertical line.

The dots of the display are individually addressable so you can have dot resolution graphics on a 7 by 156 display — the later section on the BASIC will cover this point in further detail.

The Physical Machine

The case is, if anything, slightly better made than that of the PC-1211 — that is to say 'nice'. A couple of extra features have been incorporated: provision for a mains power unit, normal AA size batteries instead of mercury cells, connection for a 4 or 8K RAM pack and the expansion port.



Right: The range of typefaces and an example of 'string art' drawn by the CE-150.

The batteries caused a slight panic when the system arrived — we couldn't get the machine to work once we had fitted them. Programs were entered and promptly forgotten and tempers became frayed. However, after long and careful study of the manual, we discovered that you have to tell the brute that you have changed its power source . . .indeed it actually asks you if you have replaced the batteries. Red faces all round!

Subsequent dismantling of the machine for photography meant that we had to take the batteries out, yet we found the program stored in the machine was still present when we reassembled it some fifteen minutes later. I suspect, however, that this is not recommended practice!

The expansion connector consists of a 60-pin female connector. No information is provided about the signals present but it seems that considerable expansion will be possible.

General Operation

The system operates in three distinct modes: RUN, PROgram and RESERVE. The former two are selected on a toggle basis by the red MODE key. In RUN mode, programs can be executed and immediate mode commands will also operate.

Program execution makes use of the DEF facility by allowing programs to be labelled. This means that you can store a number of different programs and select the one you want — keying 'DEF C', for example, will cause the program labelled C to run. You can also create 'auto RUN' programs by including the command ARUN as the first statement and turning the machine off in RUN mode. Then, simply turning the power back on will execute the program.

In the PRO mode, programs can be entered and edited. If an error is detected in a program on running it, you have to switch modes before you can edit. The editing is carried out with the four cursor keys which move the current displayed line up and down, and shift the cursor left and right. If a line will not fit in the 26 characters available, the displayed line can be scrolled using the cursor right key. When a line scrolls, its line number is kept static at the beginning of the line, which is extremely useful should you forget which line you are editing. The Delete and Insert keys can be used to alter program lines in much the same way as on the CBM and MZ-80A ***et al.*** As all keywords are stored in a single step of memory, they can be deleted with a single depression of the Delete key.

The RESERVE mode is entered by pressing Shift and then MODE. It can be left by pressing the MODE key on its own, which will return you to the RUN mode. In the RESERVE mode the top row of six keys may be defined. These keys are used in conjunction with a three level shift control, giving in effect 18 user definable keys. A Roman digit (I, II or III) is displayed at the top of the display to indicate which of the three levels is current. Levels are changed by pressing the double arrow key, next to the space key. To define a key, you enter RESERVE mode, select the required level, press the key to be defined, type the text to be stored under the key and press 'Enter'. All the keys can be cleared by typing NEW in this mode. If any keys are not defined, they take on the shifted characters written above the keys on the keyboard.

With 18 keys, it is easy to forget what keys are doing what, so a means has been devised to display the uses of the keys. Any text typed between quotes, not assigned to any specific key, will be stored under the RCL key. When you go back to RUN or PRO mode, pressing the RCL key will bring back the text. Thus, if you store some information under the RCL key at each level relating to the functions of the keys at that level, you have an instant reminder. Using the @ symbol, Return characters can be placed in the string of characters stored in a key. This allows full commands to be stored and recalled, without the need for the user to press 'Enter'.

As an aid to quick programming, a number of common commands have been pre-defined and reside under the top row of alpha keys. The functions are called by pressing DEF then the required key — an overlay is provided as an aide memoir until you become familiar with the system.

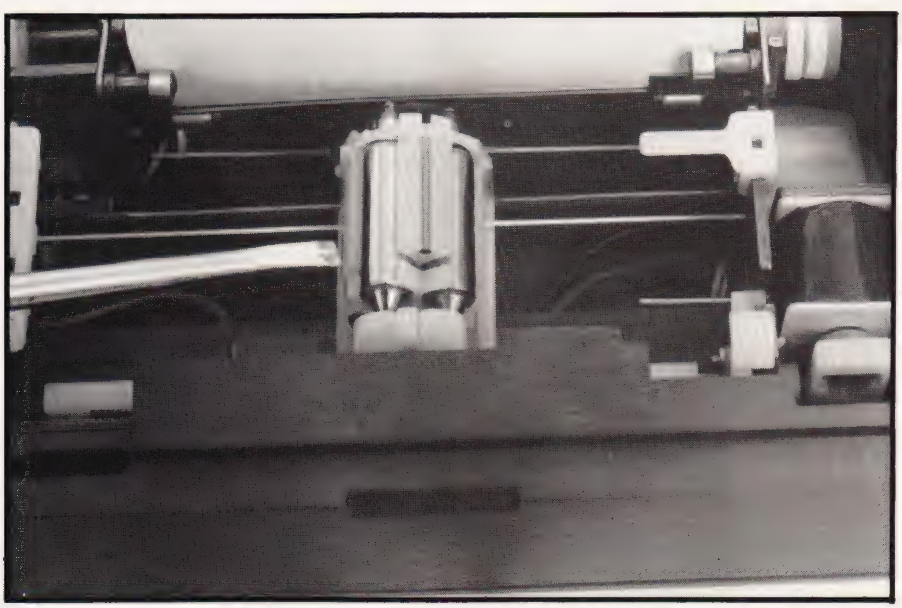
Basically Speaking

The BASIC supplied with the PC-1500 occupies some 16K of ROM, together with whatever monitor/ operating system is present. It seems to be an off-the-shelf Microsoft package, not least because there are some features of Microsoft which are valid in PC-1500 BASIC which are not mentioned in any of the manuals. Because of the close similarity with Microsoft, I will only cover those statements not supported in the former.

The only features of Microsoft's 8K BASIC not supported, as far as I can tell, are the provision of user defined functions, POKE, PEEK, USR and integer variables. User defined functions are extremely useful but the others seem a little out of context in a machine of this type.

The error messages generated by the system are of the form 'ERROR N IN X', where N is the error number and X is the line number where it occured. These numbers are only explained in the manual; I would have like to have seen a reference card with the messages printed on them. I was interested to note that there is a strong similarity between the error numbers of the PC-1500 and the new MZ-80A from Sharp (Z80A based). Could it be that the machines are in some way related?

ON ERROR GOTO is provided,



Left: The heart of the CE-150. Four tiny ballpoint pens in a rotatable holder.

but as there is no facility for discovering what the error was from inside the routine and equally no information as to its location, the feature is of questionable usefulness!

Before diving into a description of the BASIC statements, PC-1211 users will be pleased to hear that *every* PC-1211 instruction has been retained. I didn't have a PC-1211 to hand, but it wouldn't surprise me if the two machines could LOAD each other's cassettes.

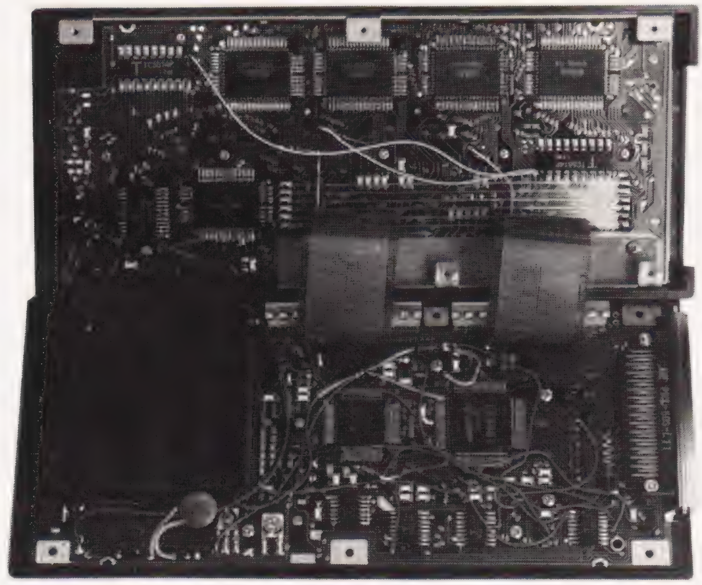
All the familiar string handling commands LEFT$, RIGHT$, MID$, VAL, STR$ and CHR$ are provided. The only catch is that all string variables must be of 16 characters or less, unless specifically DIMensioned. Single character variable names of both types are always present thus speeding access to them. The variables @() and @$() can be used to access any of the simple variables by treating the 52 variables as two arrays, thus @$(3) is the same as C$ and @(20) is the same as T. Multi-character variable names are legal, as long as they follow the accepted rules of 'letter then any alphanumeric character'.

INKEY$ will read the character currently being pressed on the keyboard. A simple loop printing the ASCII codes of every key pressed produced some fascinating results. First, INKEY$ takes no account of the Shift key or the DEF key. Both keys generate their own codes, less than 32. I found it intriguing that the DEF key generated a code of 27, normally referred to as ESCape, and is in the same position on the keyboard as the ESCape key on a standard computer keyboard. Terminal activities seem to be in the minds of the gentlemen at Sharp.

A RND function is included, which normally takes an argument greater than 1 to generate an integer random number in the required range. A RANDOMise statement initialize the random number generator.

The graphics commands are also interesting. Commands are provided to set or reset a single row of seven pixels, arranged vertically, of the possible 156 columns. POINT gives the status of any column. When GCURSOR is used to move the graphics cursor to any column, character printing will also start from the same point. As the grid for graphics work is finer than that for character printing, it is possible to over print characters and make them overlap. This technique can also be used to print special characters.

The internal layout of the PC-1500 is incredibly neat and tidy. A copious number of multi-legged ICs abound to provide the processing power.



Some Other BASIC Functions

The list of functions provided for the BASIC programmer could go on and on, so possibly the best way to illustrate the sort of features provided is to refer you to Table 1 which covers some of the more interesting ones.

Statement	Function
ACS	Arc cos.
ASN	Arc sin. (These are not normally available.)
DMS	Converts an angle from degrees/minutes and seconds of an arc to a decimal degree value. The complementary function is also available.
LN	Natural logarithms.
LOG	Logarithms to base 10.
TIME	Real-time clock.
BEEP	Just what it says!
RESTORE	As usual, except that a line number may be used allowing DATA to be stepped through.
TRON/ TROFF	Debugging functions.
PRINT USING	Formatting command for PRINT.
&	Indicates a Hex constant.
WAIT	Delay function for the time text stays on the display.

Table 1. Some of the more unusual commands available in the PC-1500's repertoire.

The Printing Package

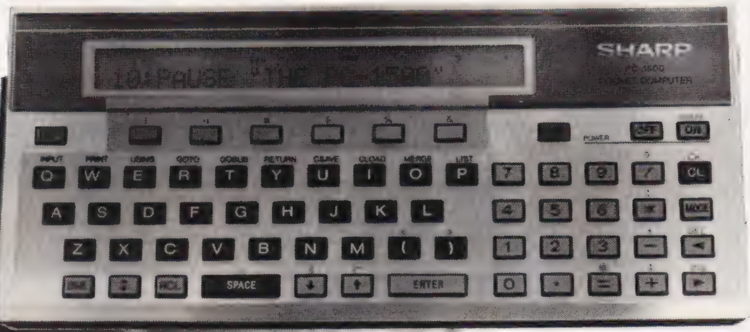
The cassette interface can support up to two cassette recorders, both with motor control. The leads to the cassette recorders are terminated with 2.5 mm and 3.5 mm plugs since the DIN levels are not sufficient to drive the unit. The firmware providing the cassette commands lives inside the CE-150 — entering the commands without it connected results in a Syntax Error.

Commands are provided to CHAIN programs from either cassette recorder, to CLOAD and CSAVE programs from and to either cassette recorder, and to verify saved programs with CLOAD?

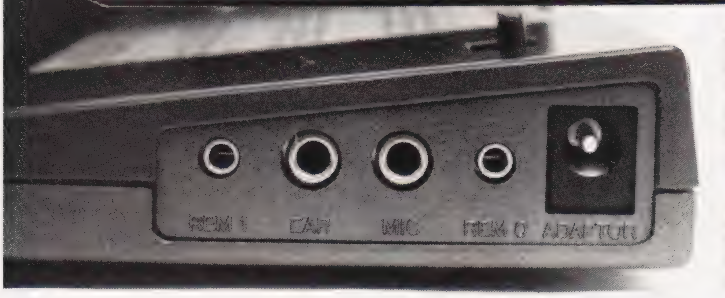
I found the MERGE facility useful when developing programs. However, it would have been more useful if some form of renumber command had been built into the system since the computer will happily merge two programs with the same line numbers.

I found the cassette interface extremely reliable, if somewhat slow. A reassuring feature is that all cassette 'noises' are played through the PC-1500's internal speaker. This can be turned on or off with BEEP ON and BEEP OFF.

The printer/plotter tended to run down the rechargable batteries of the CE-150 with astonishing speed, so I ran it off the mains adaptor (included in the price) almost exclusively. The tiny rolls of paper were finished in about two days each, but test conditions did necessitate a large number of printouts.



Above: The PC-1500's keyboard layout. The single key programming overlay can be seen.



Left: The cassette interface can handle two tape units.

There were two controls for the printer/plotter part of the CE-150: paper feed and calculation print. The former just advances the paper and the latter allows all manual calculations carried out in RUN mode to be preserved on the printer.

The plotter itself consists of a small barrel holding four tiny ball-point pens — each about a centimetre long and coloured red, green, blue and black. The required plotting colour is selected by a statement of the form COLOR N, where N is an expression in the range 0 to 3. Whenever this statement is executed, the print head moves to the left-hand side of the paper and rotates until the correct pen is uppermost. This is a time-consuming task at the best of times and requires some skillful programming to minimise the effects of such delays. The actual plotting is carried out by a combination of moving the printhead from side to side and moving the paper up and down. It is a truly fascinating process to watch!

Characters are plotted in the same way as they are generated on vector type CRT displays. Each character is made up of a series of horizontal, vertical and diagonal lines. When text is printed normal size, these changes of direction merge into curves, but in the larger character sizes, you can see the way the charcters are actually formed.

The plotter works beautifully and is very well engineered. I can only refer you to the sample printouts for an idea of how well it draws. The disadvantages are the previously mentioned delay when changing colour, and the way the printhead sometimes makes unnecessary movements when drawing lines.

Table 2 gives a breakdown of the commands associated with the plotting part of the CE-150.

Booking It

The documentation supplied with the system comprised the excellent, if a little dry, applications manual (is this obligatory with pocket computers?) and a user manual. The user manual was good, except for the appalling English. Sharp do not seem content at translating their documents to English, so this manual appears to have been translated into American.

Some of the programs in the application program manual operate without the plotter. Most require it, and some also require the RAM expansion module. They all were of high quality and useful in some sphere of life or other. The bar and pie chart drawing programs, while not up to the HP-83 standard, would be very useful in a business installation, for instance.

On the whole, the documentation is good and very readable. I doubt if a beginner could learn to program it, but someone with experience of programmable calculators should be able to.

The Last Word

Few computer reviewers acutally buy the computers they review. However, I was so impressed with the PC-1500 that I bought it (I couldn't afford the company). It is a very pleasant machine to use, it does everything you want and, Clive's Spectrum notwithstanding, is extremely good value for money. The PC-1500's most attractive feature is its size and its ability to interface with the CE-150 printer/plotter/cassette interface. The future apparently holds an RS232 interface and a digitiser. No mention of 3½" discs yet though!

In conclusion, the whole system is a delight to use and well worth the price. We only have to wait for some enterprisng company to market software for it now.

Statement	Function
COLOR	Changes plotting/printing colour.
CSIZE	An expression in the range 1 to 9 sets the size of the characters printed.
GLCURSOR	moves the graphics to coordinates X,Y. (The abbreviation for this command is 'GLC'!!!)
LF	Moves the paper up or down by the specified amount.
LINE	Draws lines, boxes or points. There are ten different types of line, with differing numbers of dashes per inch. The line drawing commands can either take on argument, in which case they draw from the last point visited to the point specified, or they can join two or more points. The colour of the line can also be specified in the LINE statement.
RLINE	Relative form of LINE statement.
LLIST LPRINT	The same as LIST and PRINT, except output to the plotter.
ROTATE	Sets the direction for printing characters. This can be up, down, left or right. An obvious use of this facility is in labelling graphs.
TEST	Prints a test pattern of a box in each colour.

Table 2. The plotter commands

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When Robert Snapp of Snapp-Ware sat down to start to write his line of utilities for the Model II and Model III Tandy machines, he made one very important decision. Wherever possible the utility was to be embedded in the Basic interpreter so that the user would have maximum ease of use. This has been so successful that unless an appropriate notice were displayed on entering Basic, the operator would literally never know that the enhancements were present.

Snapp-Ware has achieved fantastic success in the United States, but has not really been promoted to any extent in this country. We have now been using Mr. Snapp's utilities for some time and we intend to try our best to change this state of affairs, not only because we want Snapp software to sell, but also we sincerely feel that the Tandy user should have the benefit of these utilities, some of which are capable of cutting the Basic programmer's time down by an astounding amount.

In order to achieve this promotion, we have decided to market Snapp-Ware at the **same price** in the United Kingdom as it is sold for in the United States (the calculations being on prices existing in March 1982 and using $2 to the pound conversion rate).

The three most important utilities are Extended Basic, Extended Built-in Functions and Garbage Collector. These, and the others, are so comprehensive that it is not possible to describe them in full in this advertisement so a pamphlet has been prepared describing the whole line and is available on request. A short description of the three mentioned follows, but it must not be forgotten that these are all built-in utilities — they are essentially a part of the interpreter and therefore transparent to the user.

EXTENDED BASIC

Single Keystroke Commands There are six, essentially duplicating those in NEWDOS + for displaying first and last lines etc.

Single Letter Abbreviations There are ten of these covering such commands as EDIT, KILL, CLS and DELETE.

Cross Reference Extensive cross reference for variables and integers.

Dump Dumps all variables to the screen or to the printer with the current values.

Renumber Deluxe renumbering utility, including moving.

Find Locates all strings and basic keywords in a program.

Compress Reduces a program to its minimum configuration.

EXTENDED BUILT-IN FUNCTIONS

The most important function in this suite is a super fast in-memory sort routine capable of sorting (for instance) 2,000 strings in 10 seconds, or 10,000 integers in 39 seconds. These figures are for random items.

In addition, there are about 30 (depends in part on whether it is a Model II or Model III machine) extra commands such as — for the Model II, PEEK and POKE; the ability to read a string straight from the video display on the Model II; returning row numbers on the Model III; packing and unpacking strings on both machines.

GARBAGE COLLECTOR

This utility essentially gets rid of the annoying apparent hang up which is inherent in Microsoft Basic when it is sorting out its string space. The use of this utility means that this problem is really no longer existent. Two versions are supplied, one which uses a working file in memory and the other on disk. The following is a table of comparisons carried out by Snapp. It will be seen that the time saving is dramatic even if a disk work file is used.

No. of Strings	Normal Time [secs.]	In Memory [secs.]	Disk [secs.]
250	5.1	.42	2.36
500	20	.98	3.87
1000	75	2.34	7.40
2000	294	5.40	14.30
4000	1168	12.40	29.10

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  - > **BLOCKED** (variable length) files are supported.
  - > **DOS** commands may be executed from **LBASIC.**
  - > Built in string array. **SORT.**
  - > Single stepper for debugging.
  - > Several new statements and file modes.
- A compiled **JOB CONTROL LANGUAGE (JCL).**
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- An Extended Debugging and Monitor program (with disk access).
- **CMDFILE** for movement of disk and/or tape system (**/CMD**) files.
- Device independent operation.
- Full **LINK**ing, **ROUTE**ing, **FILTER**ing and **SET**ting are supported
- MiniDOS feature for constant access to certain **DOS** commands
- **RS-232 DRIVER** for serial support
- Sophisticated communications software included
- Wildcard characters and partial Filespecs are supported.
- **DATED FILES**, show when a file was last written to
- Backup: Mirror, by Class, if Modified, by Date, by Extension, etc.
- Selectable **PURGE** for fast disk "cleanup" of unwanted files.
- Print formatter, for control of printer output.
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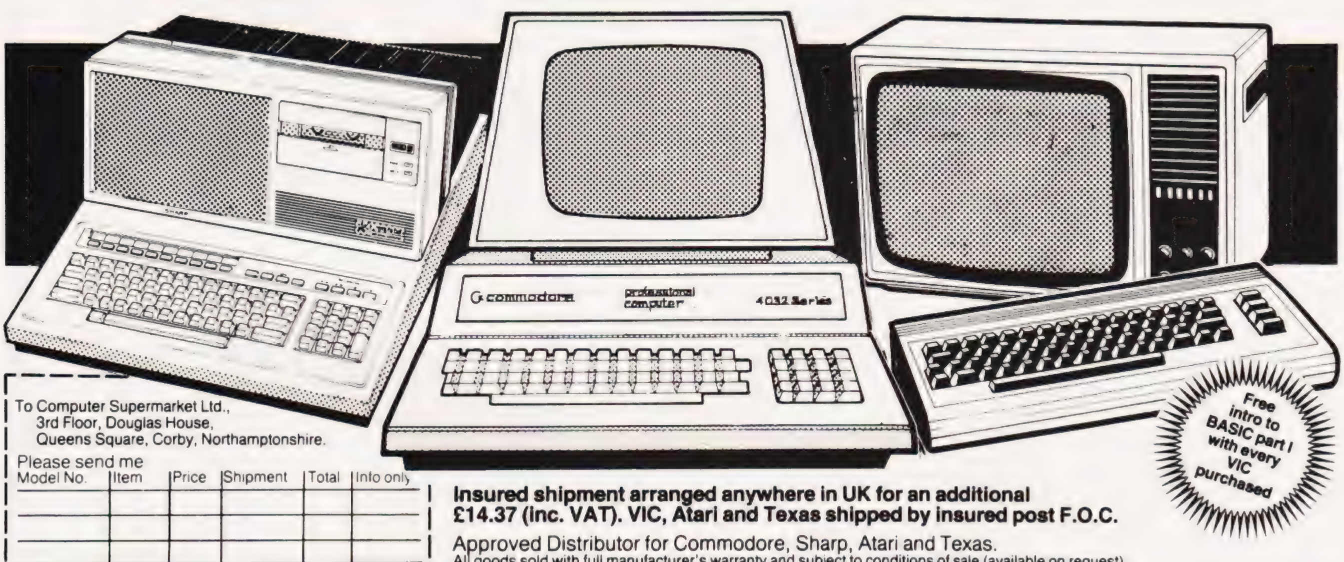

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DISPLAY PLANNER

If you've been cursing your displays why not use the cursor to plan them better?

A P Gavriluk

This simple program should be of use to anyone writing programs which use visual displays on the NASCOM 2.

Its function is to allow you to type anything on the screen, except @, and the program will give you the Hex and decimal value of the current cursor position. This will enable you to type the display onto the screen, manipulate it to give the best format, and then pass the cursor over it reading off the values as you go.

The Program

The program was written for the NASCOM 2 and uses both the monitor and the BASIC. Although it is relocatable the best position is 0E00 where it is out of the way of both BASIC and the monitor yet still leaves room for other user routines.

To run the program, BASIC must be started and then the routine executed. At this point the cursor should be present in the middle of the screen. Pressing any key other than @ should output the current location, pressing @ will return to the monitor.

The program itself makes use of various monitor and BASIC routines and is really just a series of calls. The only point worth note is the call to F9AD which is a BASIC Hex-to-decimal conversion; the number to be converted must be in the HL register at this point.

Program Listing

```
0E00 21 DF 09              LD HL,09DF     INITIALISE
0E03 22 29 0C      START   LD (0C29),HL
0E06 DF 7B                 SCAL 7B        BLINK
0E08 FE 40                 CP 40          CHAR=@?
0E0A 20 02                 JR NZ MOVE
0E0C DF 5B                 SCAL 5B        TO NAS-SYS
0E0E F7            MOVE    RST 30         OUT A
0E0F 2A 29 0C              LD HL,(0C29)   GET LOCN
0E12 E5                    PUSH HL        SAVE IT
0E13 E5                    PUSH HL
0E14 21 0A 08              LD HL,080A     PUT CURSOR
0E17 22 29 0C              LD (0C29),HL   TO TOP LEFT
0E1A E1                    POP HL         RESTORE LOCN
0E1B DF 66                 SCAL 66        OUT HL
0E1D CD AD F9              CALL F9AD      CALL BASIC
0E20 E1                    POP HL
0E21 18 E0                 JR START       AGAIN
```

TWO FOR ONE

A couple of programs for Sinclair's ZX81 give you the chance to attempt the Grand Slalom or bomb your favourite city.

Mark R Harrison

This program demonstrates two of the ZX81's system variables called FRAMES and DF-CC. The length of time that the skier lasts is calculated by using FRAMES. The value stored in FRAMES is decremented by 1 every time the television screen is scanned and, in the UK, this happens fifty times every second. By presetting FRAMES with a known initial value, the length of time can be obtained by comparing this initial value with the actual value of FRAMES as done in line 70. By subtracting the two values, the number of times the screen was scanned is obtained and by dividing by fifty, this gives the time in seconds.

The obstacles that the skier must negotiate are printed on line 16 of the screen in a random position of up to four columns either side of the skier. They are made to move towards the skier by SCROLLing the display up two lines. To see if the skier has been hit by an obstacle, the skier's PRINT position is set up as in line 40. DF-CC contains the address of the PRINT position. By PEEKing the address stored in DF-CC, the position that the skier is to be printed on can be checked to see if an obstacle is present. If not, the skier can be printed and the program can continue otherwise the time that the skier lasted is calculated and displayed on the screen.

System Variable	Adresses
DF-CC	16398/9
FRAMES	16436/7

Game Plan

The object of the game is to control a skier and avoid as many obstacles as possible. The two control keys are those with < and > printed on them.

When a skier hits an obstacle, the length of time that he lasted for is displayed along with the best time obtained.

To play again, press NEWLINE or to return to command mode press any character followed by NEWLINE.

```
5    RAND
10   LET B = 0
15   LET Z = 15
20   CLS
25   POKE 16437,255
30   POKE 16436,255
35   SCROLL
40   SCROLL
45   PRINT AT 0, Z;
50   IF PEEK (256 * PEEK 16399 + PEEK 16398) = 52
     THEN GOTO 70
55   PRINT "V"; AT 16,Z - 4 + RND * 9; "0"
60   LET Z = Z + (INKEY$ = "M" AND Z < = 25)
     (INKEY$ = "N" AND Z> =5)
65   GOTO 35
70   LET T = INT ((65535 - PEEK 16436 - 256 * PEEK
     16437)/50)
75   IF T > B THEN LET B = T
80   PRINT AT 16, 0; "TIME "; T, "BEST TIME ";B
85   INPUT Q$
90   IF Q$ = "" THEN GOTO 15
```

The object of the game is to completely destroy a group of buildings. Your aircraft will take as many sweeps over the building as required but each time the aircraft will be at a slightly lower altitude. To release a bomb press key 'B'. On each sweep you are limited to two bombs. It is important to bomb the taller buildings first because the aircraft will be destroyed if it hits a building.

The program illustrates the use of the ZX81's system variable called DF-CC (address 16398/9) which contains the address in the display file of the PRINT position. The main difficulty with the program is to detect if the aircraft has hit a building. The aircraft is displayed on the screen by PLOT X,Y where X and Y are controlled by two FOR loops. Before the aircraft is displayed on the screen the PRINT position is set to where the aircraft will be PLOTed by PRINT (43 - Y)/2, X/2; . The contents of the address which is stored in DF-CC is now the CODE of the character that the aircraft will be PLOTed on. This value is found in line 60 and providing the aircraft has not hit a building this character will be a space (CODE 0) or a NEWLINE (CODE 118).

Line 75 checks to see if a bomb has been dropped and that both bombs have not been used. If a bomb is dropped, the buildings below are demolished by UNPLOTing the squares which are in the path of the bomb.

To make the task of the bomber harder, the number of bombs for each sweep may be reduced to 1 by ammending line 45 to LET B = 1 or by making the initial height of the aircraft lower by reducing the initial value of the control variable in line 40.

```
5     RAND
10    CLS
15    FOR X = 0 TO 15
20    FOR Y = 16 TO 3 + RND * 12 STEP -1
25    PRINT AT Y, X; "■"
30    NEXT Y
35    NEXT X
40    FOR Y = 39 TO 13 STEP -1
45    LET B = 2
50    FOR X = 0 TO 31
55    PRINT AT (43 - Y)/2, X/2;
60    LET P = PEEK (256 * PEEK 16399 + PEEK 16398)
65    IF P<>0 AND P<>118 THEN GOTO 115
70    PLOT X, Y
75    IF INKEY$<>"B" OR B = 0 THEN GOTO 100
80    FOR I = Y -1 TO 11 STEP -1
85    UNPLOT X, I
90    NEXT I
95    LET B = B - 1
100   UNPLOT X, Y
105   NEXT X
110   NEXT Y
115   INPUT Q$
120   IF Q$ = "" THEN GOTO 10
```

ATOM SAVER

If you've ever wanted to re-run part of a program once it has been stopped then you need this variable saver.

S Draper

The routine given here will, hopefully, be of use to people who wish to stop a program at some point and then continue it with the same variable values at a later time. It can also be used to transfer variables from one program to another.

On the ATOM this could be done by using the PUT and GET instructions, but this would be slow if all the variables were required.

The following routine may be saved as a machine code file and thus take up only 58 bytes of memory. It makes use of the OSLOAD and OSSAVE system commands to save the variable space as a file. Note, however, that this routine will not save arrays. The command to actually save the variables is LINK Z.

```
2000  DIMP(-1);X=P
2010  [
2020  LDX@#90;STA#80;LDA@0;STA#91;
      STA#94;LDA@13
2030  STA#81;LDA@128;STA#90;JMP#F96E
2040  ]
```

The following routine will restore the saved file into the variable space by the command LINK X. Note that both routines begin with DIMP(−1) and if both are to be used in the same program one of these must be changed to avoid one routine being assembled over the other.

```
1000  DIMP(-1);Z=P
1010  [
1020  LDX@176;STX#80;LDA@128;STA#90;
      LDA@0;STA#91
1030  LDA@13;STA#81;LDA@3;STA#93;
      STA#97;STA#99
1040  LDA@#21;STA#92;STA#96;LDA@#8D;STA#98
1050  JMP#FFDD
1060  ]
```

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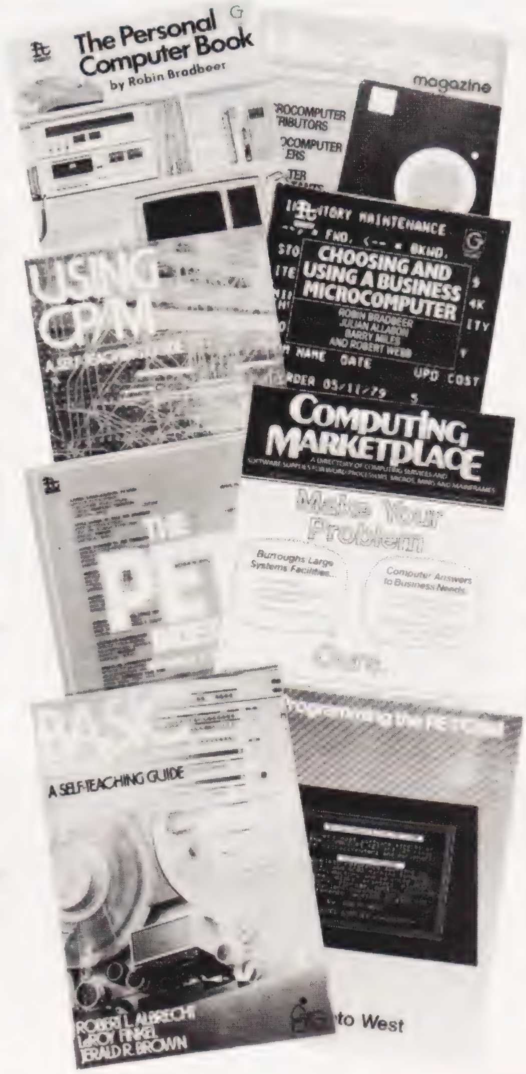

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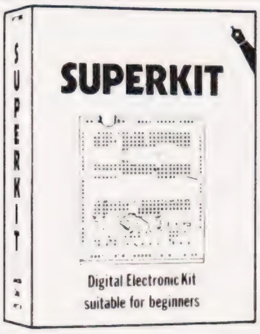

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VIEWPOINT

Derek Tidman

OK, you've bought your computer and learnt to program it. Now you want to expand and the first item on many people's lists is a printer... but is the choice really that simple?

About a week ago I made my second most important computing purchase — I bought a printer. Ever since I got the hang of programming I couldn't help noticing that if the beast was to be used for anything serious, a printer would be required. But, like all expensive purchases, the acquisition of a printer had to take its place in life's list of priorities.

In order to justify reaching the number one position in that list a real need had to be established. However, as my programming improved, more and more applications arose until the lack of a printer became a definite obstacle to using the computer for business.

The State Of Play

This, then, was the situation:

1) I owned a Sharp MZ80-K
2) I was far from rich
3) I was not a hardware expert
4) I was thinking of changing systems at a later date
5) I wanted an easy life!

The foregoing meant that I was looking for a printer that I could afford (for 'afford' read 'cheap'). That, in turn, meant a compromise on both quality and speed along with the immediate dismissal of those printers using special paper. That's not to say that printers using special paper are no good, it's just that I envisaged using large quantities of paper and, therefore, that kind of printer wouldn't make economic sense.

The fact that I owned an MZ80-K also had more than a little influence on my decisions. To cut a long story short, my short list consisted of Sharp's own printer, the Roxburgh RX8000 and the Epson MX80F/T. Sharp's offering was dismissed on two counts; firstly when I changed my system it was possible that I wouldn't choose another Sharp. Secondly, as well as the actual cost of the printer was the interface box which added another £90 or so to the price.

After checking around the rest of the printer market I finally opted for the Epson, a device I felt offered the widest dealer network and support. It also appears to be the most adaptable which is important if you have to keep one eye firmly fixed on your next purchase.

Doing The Deal

The next stage was to 'phone around looking for a deal. This is necessary because the printer market is so competitive and dealers are reluctant to publish prices.

I finally purchased the printer from Sharpsoft in London, having dealt with them before. I won't disclose the price I paid but it was certainly competitive and they are near enough to be able to return the printer if service is needed.

The big day arrived at last, the printer had arrived and I'd set aside a whole day from my business to play with the new toy... and I'm glad I did! As I unpacked the printer the first thing I encountered was a small book. 'What's this' I remember thinking, '...after all, it's only a printer.' I was later to find out!

With the printer successfully extracted from its sturdy womb, a number of jobs were required before the moment of printout could begin. As I had purchased a non-standard interface I was given the dubious honour of installing it. The single PCB fitted neatly into the space inside the printer where interface boards are meant to go, but a 20 minute search of the garage was necessary to locate some suitable self-tapping screws.

After fitting the interface I began to look for the DIP switches referred to in the text, but to no avail. Referring to the manual I discovered that these are located directly under the interface board so recently installed... Sigh!

Following the reaction to a feature we recently published called 'The Teacher's Tale', we are throwing open a page a month for comment and opinion on the micro industry in general. Submissions for this feature should be between 1500 and 2000 words in length and a flat fee of £25 will be paid on publication for any material we use.

Options expressed on this page are those of the author and are not necessarily endorsed by the Editor.

The Soft Solution

The printer is provided with a tape to drive the printer and this must be patched in to the BASIC tape to ensure that the printer receives commands it can understand. Without this software the printer can only be used in what is described as 'TRS80' mode; this requires re-setting of the switches and, on my Sharp, means that the printer cannot be controlled or lower case letters produced.

I have laboured this last point because I have a vision of some poor user leaving the shop with his new pride and joy under his arm, only to be disappointed by it printing page after page of garbage when he gets it home. For those of you who are into machine code or systems programming this would probably represent a challange, for the rest of us who have specific functions ready and waiting, it just represents a waste of time.

In Conclusion

By way of summary I would like to offer a list of the pitfalls encountered when you consider buying a printer while still keeping an eye to the future.

1) You may have to accept that you may not have full use of the graphics available on your machine.
2) It is more than possible that the printer will not interpret some of the control codes.
3) Ensure that the printer you select can be interfaced to your computer.
4) Check whether any extra software will be needed for your system to drive the printer; if it is, are you capable of writing it?
5) Remember that the extra cost of special paper could make a cheaper printer uneconomic in the long run.
6) If the print head is rated as a consumable, ie it wears out, how often might it need replacing and how much will it cost?
7) It is also worth checking that the paper sizes and ribbon types are generally available and not single-sourced.

I must go now, I'm running out of paper. I must go now I'm running I must go I must go Running I must go paper out.

So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9," 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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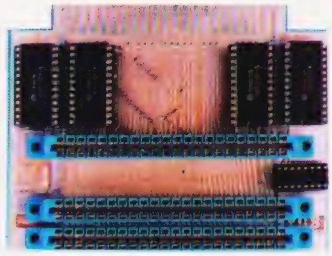
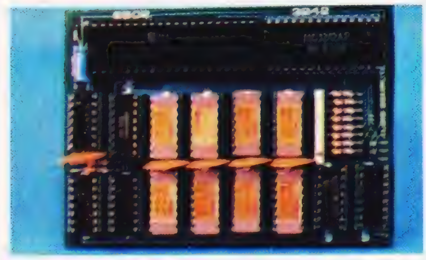

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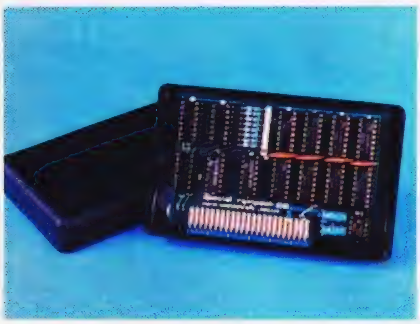
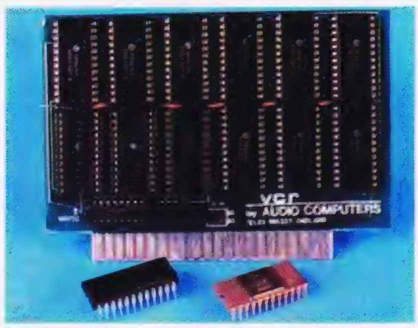

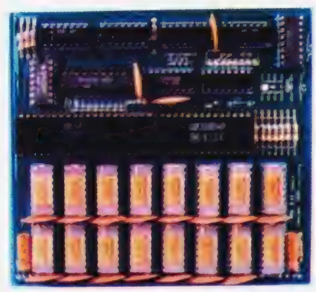

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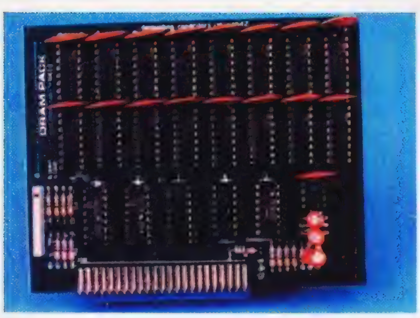

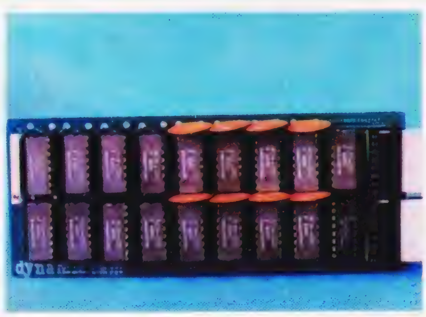
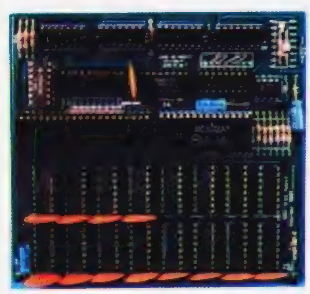

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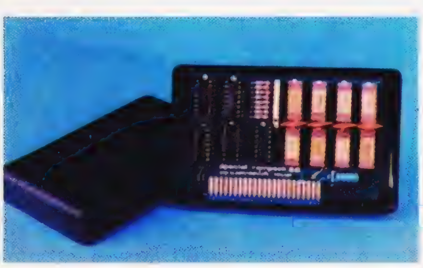
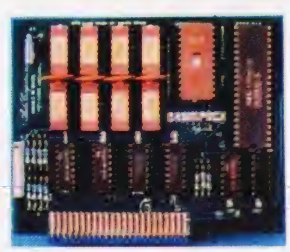

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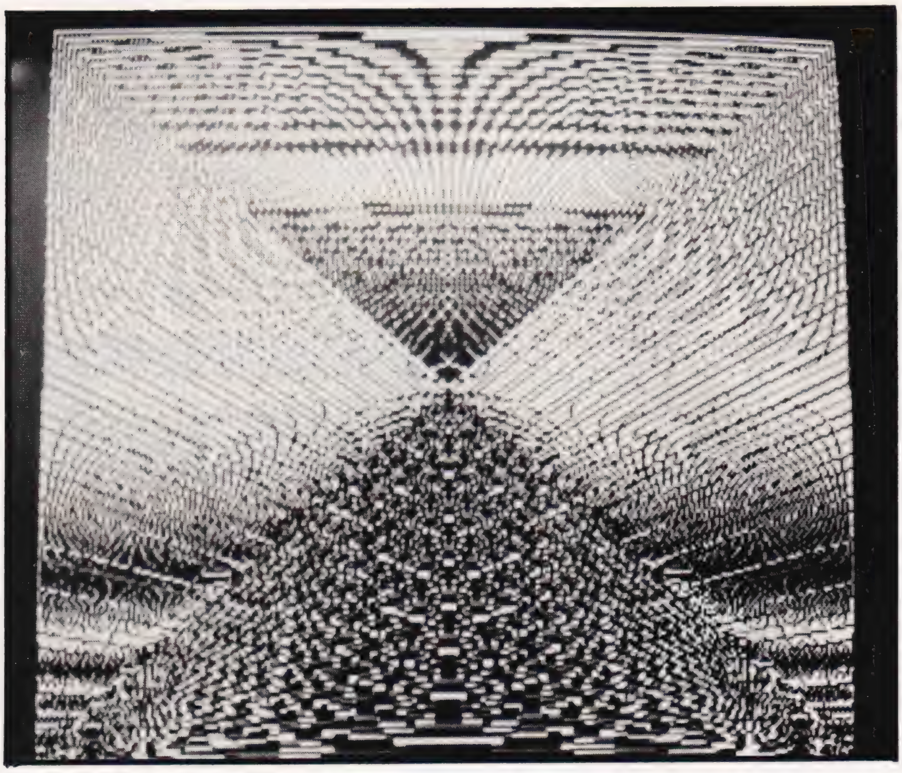
BBC PROGRAMMING

Mike James

In this, the first of an occasional series on the advanced programming features on the BBC micro, we look at the way in which its graphics features operate.

No, this is not an article on forthcoming attractions more usually found in the Radio Times! It is the first of an occasional series on the BBC Micro explaining how you can get the best from its resident software — BBC BASIC and the MOS (Machine Operating System). Obviously many different topics can be covered by such a wide-ranging title; I may not always deal with the particular areas that you either find fascinating or are having trouble with. However, what I will try to do is to show some of the programming methods and tricks that are special to the BBC machine.



A Hard Look

Although the main subject of these articles will be software, there is no avoiding the fact that sometimes the best way to understand software is to first understand the hardware! So, I'm going to begin with a discussion of how computers produce their video display followed by an explanation of how the BBC Micro, in particular, manages this task.

The BBC Micro, like many others, uses memory mapped graphics but it uses it in a very different way. Most machines that generate their own video output set aside an area of memory where the ASCII (or similar) codes of the characters to be displayed are stored. As each character's code can fit into eight bits, one memory location is used for every possible display position on the screen. For example, if you have a screen of 40 characters by 20 lines then you need 800 (ie 40 x 20) memory locations.

The way in which these memory locations are made to correspond to positions on the screen varies from machine to machine. It could be that the first memory location corresponds to the character displayed in the top left-hand corner of the screen; subsequent memory locations corresponding to screen locations to the right of the first until the end of the line is reached, when a new line is started at the far left-hand side again (see Fig. 1). The way the memory is associated with the different display positions on the screen is know as the 'screen memory map'. Obviously if you know the screen memory map for a particular machine then you can write programs to change the screen display by going straight to the correct memory location instead of using a PRINT or PLOT statement. This can be the quickest, and sometimes the simplest, way of changing the screen and is often the only way of producing good moving graphics.

As mentioned earlier, the BBC Micro uses a very different method of producing a memory mapped screen. Instead of storing the ASCII code of the character to be displayed, the BBC micro stores a bit pattern corresponding to the *shape* of the character. To make this clear it is worth considering the way other micros convert the ASCII code stored at each memory loca-

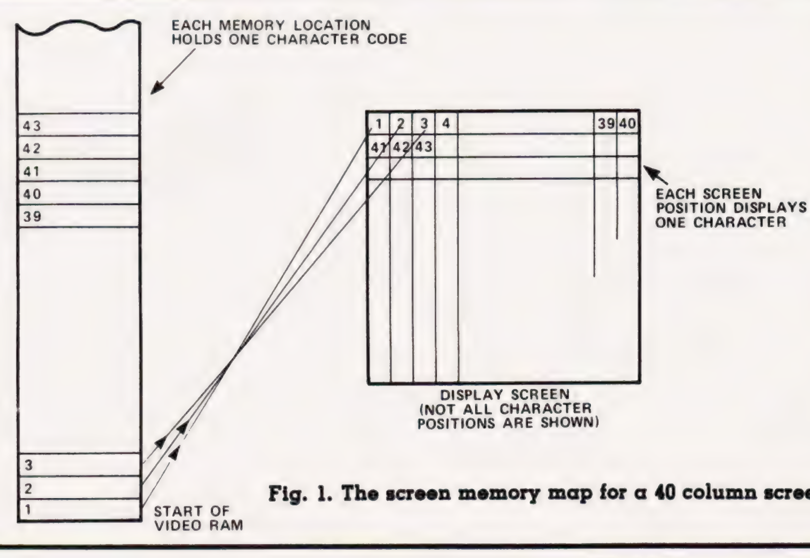


Fig. 1. The screen memory map for a 40 column screen.

tion into a character displayed on the screen.

A TV picture is built up from a series of lines and each row of characters requires a number of lines. Each character is formed from a number of dots which may be turned on or off. In this respect the BBC Micro is no different from the rest and uses eight lines of eight dots for each character (see Fig. 2). However, other micros produce this pattern of dots on the screen by using an extra chunk of memory that is accessible only to the video display electronics. This extra memory is normally called a 'character generator' but it is nothing more than a ROM (Read Only Memory) containing the information concerning which dots should be off or on to form the image of a particular character. It is because this ROM memory is available only to the display electronics that it is normally not counted as part of the computer's memory. If you want to know how much memory is involved in a character generator, all you have to do is multiply the total number of dots used to make up a character by the total number of possible characters and divide by eight (this is because the ROM has to store the dot pattern of every character that can be displayed and each dot requires one bit). For the eight by eight array of dots used by the BBC Micro, a ROM to generate the character set would have to be 2K in size.

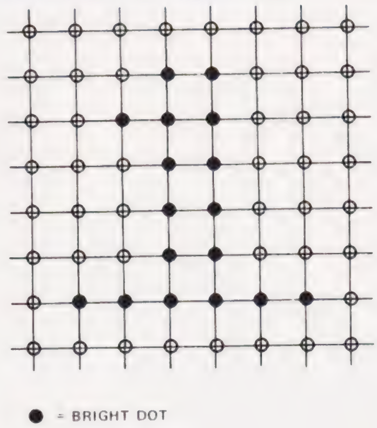


Fig. 2. An eight by eight dot matrix showing the character '1'.

The usual method of displaying characters on a screen using a character generator is simply to use the ASCII code stored in the computer's memory as an 'address' to select the location in the ROM that stores the dot pattern for that character (see Fig. 3). Instead of using this traditional approach to video display, the BBC Micro dispenses with a character generator ROM and stores the dot pattern of the character to be displayed in RAM. The disadvantage of this method is that each screen location needs enough RAM to store all the dots for a single character — in the case of the BBC Micro this amounts to eight bytes per screen location. This means that in MODE 4, for example, with 32 lines of 40 characters, the total RAM required is 32 times 40 times 8, ie 10K bytes, and all this RAM is taken from the user RAM that you might have used to store programs and data.

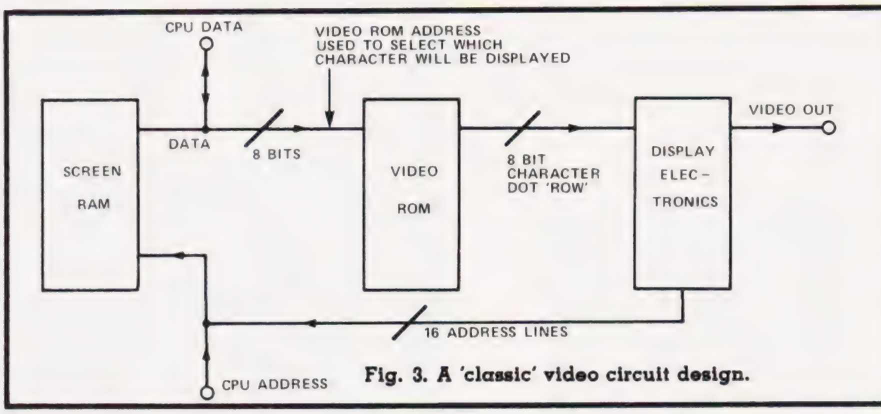


Fig. 3. A 'classic' video circuit design.

In other words, the BBC Micro uses eight times the amount of screen RAM for a given screen size — because it stores an eight bit code instead. The method the BBC Micro uses is often called a 'bit mapped display' because every bit in the screen RAM corresponds to a dot on the video screen.

What Advantage?

Given the extra memory that the BBC Micro has to use to produce its display you might be wondering what the advantages are. The main advantage is that you an produce high resolution graphics and text characters using the same hardware. Since every dot on the screen corresponds to a bit in the memory location, instead of storing the dot pattern corresponding to a character, you can change individual bits in the memory to produce lines and other shapes. Also, because the same basic method is used to display characters and to produce high resolution graphics, you can mix both ***anywhere*** on the screen. A second advantage is that the character set is not restricted to whatever is stored in the character generator ROM thus allowing you to define new characters.

These two advantages give the BBC Micro a freedom in handling both graphics and characters difficult to match using any other method. For comparison, the Apple uses a bit mapped display for its high resolution graphics but uses a standard character generator for its text modes and so has difficulty in freely mixing text and graphics without extra software (shape tables). On the other hand, the PET uses a character generator for both text and graphics and so can mix them freely but the range of graphics is limited to those already defined in its ROM

What all this means to the programmer is that, unlike machines such as the PET where POKEing a byte into a memory location causes a complete character to appear on the screen, POKEing a byte to the BBC Micro's display memory causes a pattern of dots on a single line to appear. All that we need to know now is how each memory location corresponds to a screen position and the best way to discover this is via a small test program.

If we start at the lowest screen address and POKE a byte consisting of all 'ones' then a short line of dots will appear somewhere on the screen. If the BBC Micro uses a fairly normal screen memory map, the line should appear in either the top left-hand or bottom right-hand corner. Before we can try this little experiment, however, it is necessary to look at the way the BBC BASIC allows memory to be POKEd. Although I have been using the term POKE to describe storing some data in a given memory location, this is not a term that BBC BASIC uses. To POKE a byte into memory location at 'address', the BBC Micro uses:

```
?address=byte
```

and the '?' isn't a mistake. It means 'treat the number following as an address' (familiar ground for ATOM users but a little strange to the rest of us). The address and byte used in this expression can be variables or constants. If constants are used then it is useful to know that you can specify a hexadecimal constant by using '&'. For example &01 is 1, &0F is 15 and so on.

Practical Experiments

Now we know how to alter a memory location, we can resume the examination of the screen. If you run the following program:

```
10  MODE 4
20  ?HIMEM=&FF
30  GOTO 20
```

You should now see a short horizontal line in the top left-hand corner. If you don't then it's possible that it's just off part of the screen your TV displays and a slight adjustment of the controls should make the line visible. The program works by first selecting MODE 4 and then (in line 20) storing the Hex value FF in the memory location whose address is stored in HIMEM. The variable HIMEM stores the address of the first screen location in any mode and FF in binary is eight 1s — so producing a row of eight dots.

We now know that the first (lowest) screen address corresponds to the top left-hand corner. To find out how the rest of the screen memory map goes, try the following program.

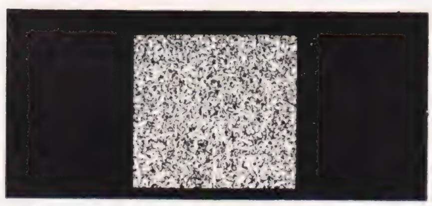
```
10  MODE 4
20  FOR I=0 TO 7
30  ?(HIMEM+I)=&FF
40  NEXT I
50  GOTO 50
```

This stores the Hex value FF in eight consecutive memory locations. What is surprising about the result of this program is that instead of producing a thin line eight characters long across the top of the screen, it actually displays a solid block about the same size as a normal character. The screen memory map of the the BBC Micro is such that the first eight memory locations form the dot matrix for the first character. The next eight form the dot matrix for the character to the right of the first and so on to the end of a line. To see the screen memory map in action, try the following:

```
10  MODE 4
20  I=0
30  ?(HIMEM+I)=&FF
40  I=I+1
50  FOR J=1 TO 50
60  NEXT J
70  GOTO 30
```

You should see the screen fill up character position by character position. You can use this program to explore the possibilities of POKEing graphics data directly onto the screen. For example, illustrating that things other than solid lines can be POKEd, try altering line 30 to:

```
30  ?(HIMEM+I)=RND(255)
```



and removing the delay loop formed by lines 50 and 60.

Using this information we can work out a simple equation that will give the address of any screen location:

```
address=HIMEM+(X+Y*40)*8+N
```

This expression gives the address of the Nth line making up the character at the screen location X,Y (N,X and Y all start from zero in the top left-hand corner).

Colourful Expansion

The reason why the previous section considered the memory map for MODE 4 is that it is a two-colour mode; this means that each point in a character can only be one of two fixed colours and so can be represented by a single bit. If a MODE uses more than two colours — sixteen for example — then you need more than one bit to represent each point on the screen. It's a little difficult to explain how many you need in general but two bits can represent up to four colours, three can represent eight and four can represent sixteen. The question is — how are the extra bits organised in the memory map of the other modes?

The answer is that the fundamental memory map outlined for MODE 4 is used for all the other modes except that each point on the screen now corresponds to a small group of bits in each memory location. For example, in MODE 4 a memory location holding eight bits gave rise to eight dots but in MODE 5 (a four-colour mode), the same memory location only gives rise to *four* dots. In this case each group of two bits determines which of the four colours a point will be (see Fig. 4).

The best way to investigate the memory maps of the other graphics modes is to use the programs given in the last section but change line 10 to give the required mode. In MODE 5, as each block of eight memory locations now corresponds to only eight rows of four dots and each character still needs eight rows of eight dots to be displayed. It should be obvious that the storage of a single character involves two such blocks.

If all this seems a little complicated then all I can say is that compared to the way other computers work *it is*. But if you want to have the sort of freedom of action that the BBC Micro allows, there is no other way of doing it! In practice, the use of direct memory mapped graphics is limited to either MODE 4 (where it is easy) or involves assembler (where everything is more difficult!!). Seriously though, POKEing the screen is not as useful on the BBC Micro as on other machines — partly because it is more difficult except in two-colour modes and partly because the BASIC provides all sorts of features that make it unnecessary. What is more important though is that a knowledge of the screen memory map allows you to find out quickly what is stored at any screen location.

PEEKing The Screen

This brings us to the topic of PEEKing the screen to see which character is stored at any particular location. This is easy on machines

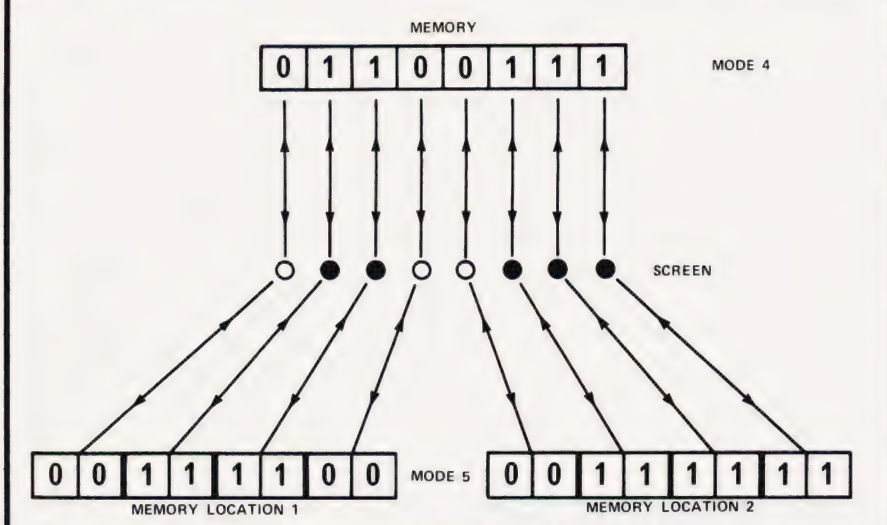


Fig. 4. The correspondence between MODEs 4 and 5 for eight dots on the screen.

such as the PET — all you have to do is to PEEK the screen location and this returns the ASCII code of the character stored at that position. For the BBC Micro things are not quite as easy.

The first problem is that PEEKing a screen location in a two-colour mode returns the dot pattern of a row of the character stored at the location. This is not as useful as the ASCII code because in general it is not enough to identify the character — for example, it is possible for two characters to have the same dot pattern in every row except one! The second problem is that for the modes which use more than two colours, even a single row of dots from a character is difficult to obtain without a number of PEEKs and quite a bit of logic.

This might make you think that screen PEEKs are not worth the trouble on the BBC machine. However, for MODE 4, things are easier than they look. The general problem of deciding what character is stored at a screen location is difficult even in MODE 4 but in most graphics-based applications this is more than we want to do. Instead of identifying which character from the set of all possible characters is present, it is usually enough to decide which one of two or three characters is there. For example, if you are using 'O' to represent one type of player and 'X' to represent another then we only have to discover if the character stored at a location is one of blank, O or X. This is a much easier problem as it should be possible to find a row of dots different in each character. If this *is* possible then you can tell the three characters apart by PEEKing that one row! in the case of blank, X and O, any row will distinguish them but row three corresponds to 0,24 and 102 respectively.

The BBC Micro uses the '?' instead of PEEK as well as POKE. If you want to PEEK a particular screen location then all you have to do is:

```
?address
```

This will return the contents of the memory location at 'address'.
For example:

```
A=?2000
```

stores the contents of memory location 2000 in A. Notice that the '?' represents a POKE if it is on the left of an equals sign and a PEEK if on the right. Now that we know how to PEEK a memory location and we know the screen memory map for MODE 4, we can write a function that will return the contents of a particular row of a screen location:

```
100   DEF FNS(X,Y,N)=HIMEM+(X+Y*40)
      *8+N
```

FNS will return the address of the screen location corresponding to character position X,Y and the Nth row of the character.

To give an example of how to use FNS, the program below will print a character on the screen at 20,10 and will then print the value of the dot pattern making up each row of the character.

```
10   INPUT A$
20   MODE 4
30   PRINT TAB(20,10);A$
40   FOR N=0 TO 7
50   PRINT N,?FNS(20,10,N)
60   NEXT N
70   END
100  DEF FNS(X,Y,N)=HIMEM+
     (X+40*Y)*8+N
```

This program can also be used to discover how any character is made up — it was used to find out the values of the third row of blank, X and O in the previous example. In practice, the function FNS would be used in IF statements to decide what should be done according to what is stored at a particular location.

Using The MOS To PEEK

There is a way of discovering the ASCII code of the character stored at a screen location but it needs a USR call to the MOS (Version 1 and later revisions only) and it is slow (about 120 milliseconds per character). However, if speed is not important then you can use the following function:

```
100  DEF FNASC(X,Y)
110  LOCAL C
120  X%=X
130  Y%=Y
140  A%=135
150  C=USR(&FFF4)
160  C=C AND &FFFF
170  C=C DIV &100
180  =C
```

FNASC(X,Y) will return the ASCII code at screen location X,Y and CHR$(FNASC(X,Y)) will supply the character itself.

The operating system call used in the above function (ie USR(&FFF4)) works by reading the screen memory, assembling the eight bytes representing the character's dot pattern (easy in two-colour modes, not so easy in the rest) and then searching an area of memory in the operating system that is used to generate the dot pattern in the first place. This area of memory is the BBC Micro's equivalent of a character generator. When you PRINT a character to the screen this area of memory — the character table — supplies the dot pattern for the character. This is fast because the table is organised so that the ASCII code of the character leads straight to the correct pattern. However, going back from the pattern to the ASCII code is slower because it involves finding a match for eight bytes somewhere in the table!

The Trouble With SCROLL

There is one feature of the BBC Micro that is very surprising and can make use of the screen address map very difficult. When you carry out a MODE command, the screen address map is set up as we have discussed and remains unaltered during the running of a program unless that program prints something that causes the screen to scroll. The action of scrolling is such a common sight on VDUs and computers that it is rare to give it a second thought. However, if you try to write a program from first principles to scroll an entire screen, you will realise what a time-consuming manoeuvre it is. Each text line of the screen must be moved up by one line. The bottom line is cleared and the top line is lost.

In the BBC Micro's case, this screen shift, if done by software for MODE 4, would need 10K bytes of storage to be rearranged — slow to say the least! To overcome this speed problem, scrolling is carried out by hardware which in effect alters the screen memory map so that the memory locations correspond to screen positions one higher. The memory corresponding to the old top line is cleared and is made to correspond to the new bottom line — ie following a single scroll, POKEing data into memory that was the top line produces output on the bottom line. Of course this 're-mapping' of the screen makes a nonsense of the screen mapping functions given earlier! However, the solution is simple — either avoid scrolling the screen following a MODE comand or adjust the functions to take account of any scrolling.

To take account of scrolling, it is necessary to keep a count of the number of times the screen has scrolled since the last MODE command. If the scroll count is kept in SC then the following version of FNS will work (for MODE 4):

```
100  DEF FNS(X,Y,N)
110  YT=Y+SC
120  YT=YT-INT(ABS(YT)/32)*32
130  =HIMEM+(X+Y*40)*8+N
```

Notice that YT and SC are global variables and are thus accessible to the main program. Luckily, it is not often that the need to scroll the screen occurs in the same situation as the need to use POKE or PEEK graphics.

Conclusion

My final comment must involve a small warning. Acorn are at pains to point out all the way through the BBC Micro's manual that non-standard ways of doing I/O are to be avoided if you want to use your software with any second processors connected through the 'Tube'. This is a valid point but then again, if your program works well on a standard BBC machine and you have no plans for using additional processors, you may find it fun to experiment.

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FILE

Once more the Editor climbs onto the soapbox and passes comment upon the world in general. Well, PEEKing, POKEing and The Valley actually but who's counting!

It is getting difficult to find new and interesting topics among the postbag these days. Just about the only two topics that appear to interest people at the moment are The Valley, of which more in a moment, and the BBC Micro.

Of Mysterious Commands

However, the following missive from Mr F Jackson of Castle Bromwich brought a ray of light into the relative darkness.

I am a newcomer to computing but having read through the magazines for the last 12 months I finally decided to purchase a Sharp MZ-80K. Thumbing through past copies of Computing Today for programs, I find that some of them use PEEK and POKE statements. Unfortunately, the manual supplied with the MZ-80K is completely without proper explanation of these commands except to say that it can be dangerous to use POKE commands carelessly and that damage could well occur.

Could this damage be permanent and would it involve the replacement of ICs? As this has put me off using programs which involve PEEK and POKE I wonder if you could help me with an explanation.

After many years in the business I think I can safely say that these two BASIC statements have caused more trouble than the rest put together. Indeed, a whole mystique seems to have built up around them which is often exploited — those who understand the commands having a sort of 'status'. Put simply there is nothing you can do in a program which will cause permanent damage to the system. All the command POKE does is to change the contents of one single location in memory; indeed if you try to change a location which is in ROM rather than RAM nothing will happen at all! The main use of the POKE statement is in graphics games where it is used to change the characters on the screen almost instantaneously.

The reverse command, PEEK, looks at a location in memory and brings back the value stored there — it actually brings back a copy and leaves the contents unchanged. This command is used, again often in games, to inspect some portion of the screen to see if your missile has hit an alien . . . or something similar.

Now, probably the best way to find out about the way these functions work (on your Sharp) is to try POKEing values between 1 and 255 to locations between 53248 and 54247. The results should be that graphics blocks appear in various positions on the screen. You should be warned at this point that if you go POKEing around outside the screen address area funny things can happen — the machine can go all dumb on you! All you have to do is turn it off and then back on again. OK, the program will have disappeared but you did save it on tape . . . didn't you?

We will be bringing you a feature on the arts of PEEK and POKE in the very near future but until then just do what the rest of us do, try it out and have fun!

Venturing Forth

Those of you who thought the headline was a subtle intro to a piece on the virtues of a certain programming language are obviously not into the world of Adventure! It appears that our contribution to the world of fantasy gaming has caused more than a little interest judging by the amount of mail we have been getting over the last couple of months. I trust that we've managed to sort out your various queries and the two bugs which slipped through my fingers (well ***somebody*** had to type it into the word processor) are by now well documented.

The single most encouraging sign of The Valley's success is that a large number of you have taken the plunge and gone ahead with conversions to a wide variety of systems. We currently have versions for the BBC Micro, Sorcerer, UK101, Apple, Atari and even the ZX81 on test to see if they match our original versions. If they do, we hope to be able to offer them under our CT Software service which will make the program available on most of the popular systems.

Many people have commented that the game can be expanded and in some ways improved by this or that alteration. We know! It was a conscious decision to publish a 16K version, the original development program occupied well over 20K with bigger versions still at various points. We will be publishing updates from time to time, starting next month (subject to testing) with a remarkable re-vamp of not just the program but the whole scenario as well. We have had criticism, one would hardly expect to undertake a project of this nature without it, but the 11 months of effort by the team has, in the main, paid off handsomely. We didn't name the writers at the time but, as several of you have asked, the team comprised Peter Freebrey, Peter Green and Roger Munford, with considerable assistance in the early game design from Ron Harris. The number of man hours invested probably runs into thousands but it was worth every minute. Next year . . . . well that would really be telling!

Help Required

We are just about to start an expansion programme in the use of our programming standards and your views on one or two points would be appreciated. Whilst the codes are undoubtely successful — one book publisher is basing a whole series of programming books around them — they might have some limitations. If you think that they fall short of what you'd like to see, first remember that no-one else even bothers and then drop a line to me at the magazine and we'll see what we can do. The sort of problems we already know about, and have solved, are the representation of VIC graphics which require two shifts and the new BBC Micro's function keys.

This last cry for help is somewhat less serious. Someone has stolen two copies of file magazines from my personal archives. Does anyone out there have spare copies of the first ever issue of Practical Computing (September 1978) or the October 1981 issue of Your Computer? If anyone has copies of these in reasonable condition which they would be willing to part with, please write and let me know — don't send the magazines at this stage. I'm voting for the Arabic method of crime prevention at the next election — cut their hands off and they won't be able to!

TARGET

Improve your aim on a Micron

I M Parker

Target is a game written in Microsoft 10K BASIC and requires 2021 bytes of memory to run.

Using a simple mixture of graphics and ASCII characters for the screen presentation, the game involves shooting at a randomly positioned target in the upper half of the screen from a moving gun turret traversing a horizontal grid line in the lower half of the screen. Below the grid line are printed the totals of 'SHOTS' and 'HITS'; these totals are incremented each time a shot is fired or a hit is made. Figure 1 shows the format.

The game length can be determined by the player selecting the number of shots, either 20, 40, 60 or 80. However, if a wrong input is made the game will automatically finish after 100 shots have been fired.

At the conclusion of the game, the screen scrolls and the various scores, ie 'SHOTS', 'HITS' and 'number of targets presented', are printed on the screen together with a prompt for another game.

Program Breakdown

140-170	Set up the value of P according to number of shots selected. P will be compared later with Y (tens of 'SHOTS') to test for game finish.
180	Clears Screen.
190-230	Set up titles ('HITS' and 'SHOTS') on screen.
240-260	Put initial grid line on screen.
270-300	Initialise counts for 'HITS', 'SHOTS' and 'TARGETS'.
310-320	Set up random integers for use in 'Target' placement.
330	Sets X to maximum value of 'SHOTS' tens.
340	Sets up counter for random target positioning.
350	Turns graphics on and puts 'Target' in random position on screen.
360	Turns graphics off, setting the value of S to 'Target' position and incrementing the 'Target' count.
370	Sets up counter for gun traverse (set for maximum width of the screen, within the limits of the program).
380	Turns graphics on and prints part of grid line (grid line will be erased by the gun so it has to be renewed).
390	Prints gun in new position and polls keyboard.
400	Turns graphics off.
410	If tens of 'SHOTS' is equal to the value of P then go to 750.
420	If contents of ICHAR (last keyboard entry) is not equal to the ASCII code for Carriage Return then go to 470.
430	Repeats from line 380 until gun has moved to limit of screen width (as set by line 370).
440	Erases last gun and erases target.
450	Repeats from line 350

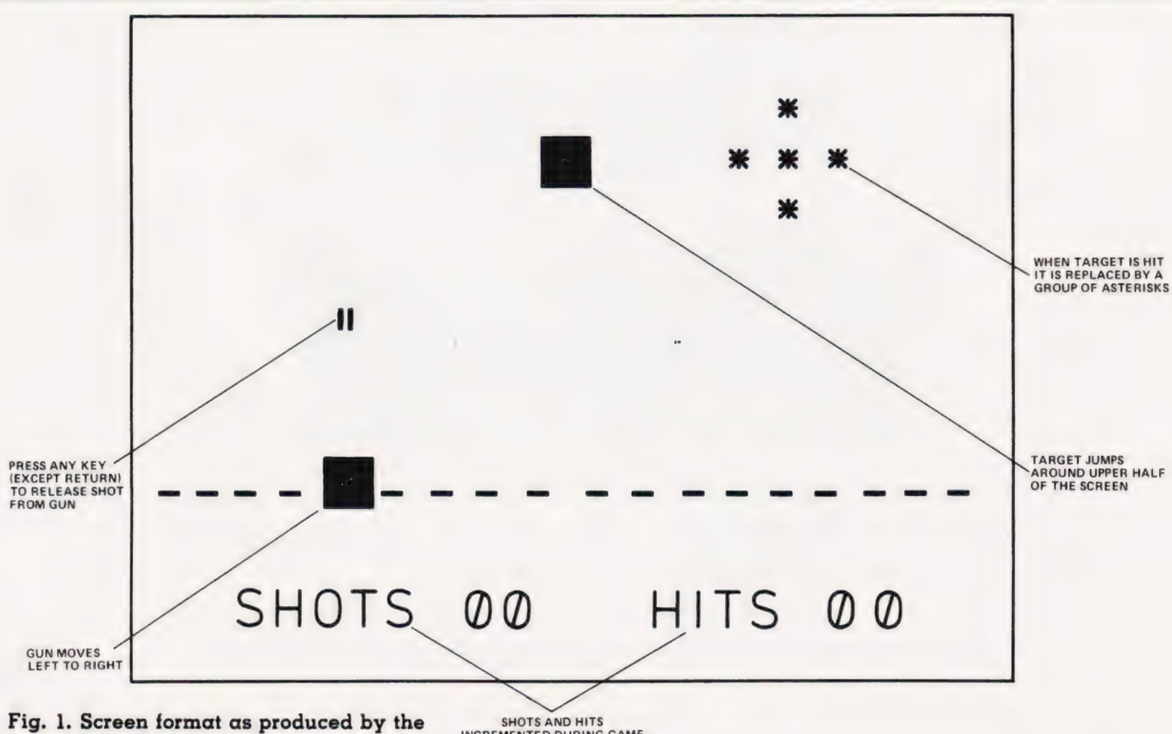

Fig. 1. Screen format as produced by the game.

(continued) until target position count is complete.
460 Repeats from line 310.
470 Sets up counter for 'bullet' positioning.
480 Turns graphics on and puts stationary gun on screen at point where 'bullet' was fired from.
490 Turns graphics off.
500 Puts bullets in position relative to count.
510 If 'Target' position is the same as 'Bullet' position then go to 590.
520 Erases 'Bullet' from previous position.
530 Repeats from line 480 until 'Bullet' position count is complete.
540 Places ASCII code for 'Carriage Return' in ICHAR.
550 Erases 'Bullet' from its final position (if target has not been hit).
560 If 'SHOTS' units are 9 then go to 690.
570 Increments 'SHOTS' count and puts updated count on screen.
580 Erases gun from its last position and goes to 430.
590 Sets up count for duration of 'explosion' effect.
600-620 Put 'explosion' effect on screen in place of target.
630-650 Erase 'explosion' effect.
660 If 'HITS' units are 9 then go to 720.
670 Increments 'HITS' count and puts updated count on screen.
680 Sets up next shot (go to 540).
690 If 'SHOTS' tens are 9 then go to 750.
700 Sets 'SHOTS' units to 0 and puts updated 'SHOTS' units on screen.
710 Increments 'SHOTS' tens and puts updated 'SHOTS' tens on screen.
720 Sets 'HITS' units to 0 and puts updated 'HITS' units on screen.
730 Increments 'HITS' tens and puts updated 'HITS' tens on screen.
740 Sets up next shot (go to 540).
750 Scrolls display 1 line.
760 Prints number of targets presented during game.
770-790 Scroll display 5 lines.
800-870 Test for another game or for finish.

Program Listing

```
10   REM TARGET
20   GOSUB 1000
30   PRINT"THIS IS A GAME WHERE THE TARGET"
40   PRINT"JUMPS AROUND THE UPPER HALF OF"
50   PRINT"THE SCREEN, AND THE GUN MOVES"
60   PRINT"FROM LEFT TO RIGHT ON THE LOWER"
70   PRINT"HALF OF THE SCREEN"
80   PRINT"PRESS ANY KEY TO FIRE THE GUN"
90   PRINT"(EXCEPT RETURN)"
100  PRINT: PRINT: PRINT
110  PRINT"HOW MANY SHOTS DO YOU WANT?"
120  PRINT"(ENTER 20,40,60 OR 80)"
130  INPUT F
140  IF F=20 THEN LET P=50
150  IF F=40 THEN LET P=52
160  IF F=60 THEN LET P=54
170  IF F=80 THEN LET P=56
180  GOSUB 1000
190  POKE 1010,72:POKE 1011,73
200  POKE 1012,84:POKE 1013,83
210  POKE 994,83:POKE 995,72
220  POKE 996,79:POKE 997,84
230  POKE 998,83
240  FOR D=0 TO 30
250  POKE 49136,0:POKE(928+D+1),32
260  POKE 49139,0:NEXT D
270  LET Z=48:LET Y=48
280  LET W=48:LET V=48: LET T=0
290  POKE 1000,Y:POKE 1001,Z
300  POKE 1015,V:POKE 1016,W
310  LET M=INT(5+20*RND(5))
320  LET N=INT(20+100*RND(5))
330  LET X=57
340  FOR B=M TO 255 STEP N
350  POKE 49136,0:POKE(544+B),255
360  POKE 49139,0:LET S=544+B:LET T=T+1
370  FOR C=0 TO 30
380  POKE 49136,0:POKE(928+C),32
390  POKE(928+C+1),255:POKE 49138,0
400  POKE 49139,0
410  IF Y=P THEN 750
420  IF PEEK(1)><13 THEN 470
430  NEXT C
440  POKE 959,32:POKE(544+B),32
450  NEXT B
460  GOTO 310
470  FOR E=0 TO 13
480  POKE 49136,0:POKE(928+C+1),255
490  POKE 49139,0
500  POKE((928+C+1)-(E*32)),34
510  IF S=((928+C+1)-(E*32)) THEN 590
520  POKE((928+C+1)-(32*(E-1))),32
530  NEXT E
540  POKE 1,13
550  POKE((928+C+1)-(32*13)),32
560  IF Z=57 THEN 690
570  LET Z=Z+1:POKE 1001,Z
580  POKE(928+C+1),32:GOTO 430
590  FOR F=1 TO 5
600  POKE S,42:POKE(S-1),42
610  POKE(S+1),42:POKE(S-32),42
620  POKE(S+32),42:NEXT F
630  POKE S,32:POKE(S-1),32
640  POKE(S+1),32:POKE(S-32),32
650  POKE(S+32),32
660  IF W=57 THEN 720
670  LET W=W+1:POKE 1016,W
680  GOTO 540
690  IF Y=X THEN 750
700  LET Z=48:POKE 1001,Z
710  LET Y=Y+1:POKE 1000,Y:GOTO 430
720  LET W=48:POKE 1016,W
730  LET V=V+1:POKE 1015,V
740  GOTO 540
750  PRINT
760  PRINT"NUMBER OF TARGETS PRESENTED";T
770  FOR K=1 TO 5
780  PRINT
790  NEXT K
800  PRINT"WANT TO TRY AGAIN(YES/NO)"
810  INPUT A$
820  IF A$="YES" THEN 860
830  GOSUB 1000
840  PRINT"HOPE YOU HAD FUN!!"
850  GOTO 1040
860  GOSUB 1000
870  GOTO 100
1000 FOR J=0 TO 15
1010 PRINT
1020 NEXT J
1030 RETURN
1040 END
```

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Bill Lounds

We show you how to add extra commands to your NASCOM's BASIC with this toolkit-type package.

Most BASIC interpreters used in microcomputers are trimmed to fit into 8K of memory. This means that many of the more useful functions of a full BASIC are missing — routines such as RENUMBER, for instance.

The NAS-SYS monitor allows the programmer to add his own input or output routines. The address of a user input routine must be placed in locations 0C7B Hex and 0C7C Hex. This in itself will not achieve anything but, because NAS-SYS uses a table of routine numbers for input and output, we must replace this table of routine numbers for input and output, we must replace this table with our own. The address of the input table must be placed at 0C75/0C76 Hex. To replace all the input routines with our own user routines, the table need only contain the Hex numbers 76 and 00. The Hex number 76 calls the user input routine, the address of which was stored in 0C7B. Having replaced the tables with our own, we then have the problem of deciding what to use for our input routine and how to decode the possible utility keywords. The input routine must, of course, leave any 'normal' lines available to BASIC, with the correct register values set.

Memory Usage

In the Zeap Assembler listing, the program is assembled at 0C80 Hex — but it will work from any allowable start location.

The program makes extensive use of NAS-SYS routines, all called by their routine numbers so that either NAS-SYS 1 or 3 could be used. This cuts down on a few bytes but increases the processing time slightly.

The utility uses some work space, but areas were chosen to be 'transparent' to the programmer. Locations 0800-0809 Hex, the first 10 bytes of the screen locations, are unaffected by a Clear Screen command and are used to store the absolute program addresses. If this area of memory is corrupted then the program will crash.

There are also 12 bytes used from location 1078 Hex, which is part of the BASIC input buffer, but that causes no problems as it is only used during the DUMP routine.

A description of the various sections of the program now follows. The numbers given correspond to the Zeap line numbers.

Setting Up (200-610) — The program clears the screen and sets ARG1 to zero. This is only needed if you have NAS-SYS 3 — if you don't know why, then try missing it out and loading a program from cassette into BASIC.

If you want an EPROM version and you usually program in BASIC, you could replace the section (200-230) with something like this:

```
LD SP £1000 — sets the stack pointer
CALL £000D — calls ST MON to set up NAS-SYS
```

You could then adjust the RESET address to start the utility at reset or switch on.

The next section (240-480) determines the present position in memory of the program so that the absolute position of the keyword table, the subroutine address table and the program start can be stored for later use.

A 'false' relative call is made (240) to the instruction which then POPs the return address, ie the present absolute memory address, into the HL register. By adding appropriate offsets, the input table address is loaded into 0C75 Hex and the user input routines into 0C7B Hex. As previously mentioned, three other values are stored at 0801, 0803 and 0805 Hex. In this section the byte to the left of line 1 of the screen is set to zero. This is to ensure that a zero byte is to the left of each line — the reason for this will become more obvious later.

At the end of the set-up section, the user is asked for a warm or cold start to BASIC. The memory size should be chosen so as not to corrupt the utility if it is in high RAM.

The New Input Routine (630-1440) — This routine starts with a call to the NAS-SYS 3 repeat keyboard scan. If you have NAS-SYS 1 then the value 7D Hex should be changed to 61 Hex. If a key is pressed, then a check for a Carriage Return is made; if it is found, a check for a keyword is made.

The fiddling with the stack (680-770) is performed to retrieve the code for the character at present under the cursor, just in case it is blanked when Return was pressed. The registers are saved and an appropriate message is printed. The character under the cursor is loaded into the DE register and replaced on screen if necessary. The HL register is then set to the start of the line. This is done by stepping left from the present cursor position until a zero byte is found (950-990).

A routine then compares the first few characters on the line with each of the words in a keywords table. The first character of each word has the most significant bit set, the end of the table being marked by an 80 Hex. As the keywords are checked, the BC register is used as a counter and if no match is found, the registers are reset. However, if a match is found then the routine from 1290 is used to pick the correct offset from a look-up table. This is loaded into HL and the offset added. The screen location of the byte after the keyword is saved in the DE register for use in the various routines. The true address of the subroutine is in HL so that a jump to the routine called can be made after the stack is cleared.

The Routines

OLD (1480-1650) — If, after an aborted CLOAD or a mistaken NEW you wish to recover your program, this routine will do the job for you. However, it will not work if the program has been corrupted for any reason (ie a cold start to BASIC).

DEC XXX — After the word DEC, you type the decimal integer you wish to change to hexadecimal. The program uses two routines in the BASIC interpreter. The routine at E836 Hex searches the memory pointed to by HL and if a valid decimal digit is found, the carry flag is set. The routine called at E9A5 Hex then converts the number into Hex in DE. This routine will only convert numbers 0-65529 (0-FFF9 Hex) — if you want the other six values, you must write your own conversion routines!

NAS-SYS calls are then used to print the Hex value.

DUMP — After a program run this routine will list the program variables, both number and string, and their current value. It does not list arrays. After each value is printed, you can press any key to continue or Escape (Shift/Enter) to stop the listing.

This section uses the BASIC print routine and requires HL to point to the first byte of the line to be printed. To allow us to make use of the routine (called at EB23 Hex), a false BASIC line is set up from 1078 to 1083 Hex as a mask. This is what is written there:

```
"Z - - =";Z - - 00
```

and in the ASCII form:

```
22 5A 20 20 3D 22 3B 5A 20 20 00
```

The BASIC work space is then searched for the variables, and as they are found, their 'names' are copied on to the mask. Thus, if the first variable was AZ$ the mask would be set to:

```
"AZ$ ";AZ$ zero byte
```

Then, when the routine at EB23 Hex is called, the line is treated as if it were part of a BASIC program.

After this, the routine at E866 Hex waits for a key press. If it is an Escape, the DUMP is terminated.

HEX XX XX XX XX — This allows the conversion of up to 10 Hex numbers into decimal. The routine works on the assumption that the numbers are 16-bit twos-complement binary numbers — this means that the most significant bit is taken to be negative. This is so that the decimal values can be incorporated into DATA statements for use in programs. In fact, the word DATA is printed in front of the converted numbers, all of which are separated by commas. A sample command string and response are shown below:

```
HEX FF AA FFFF 8000
DATA255,170,-1,32768
```

The cursor is positioned at the D. If the numbers are all large you can lose figures over the end of the line when the shifting to put the word DATA in takes place.

The routine works by calling the NAS-SYS routine DF79 Hex which places up to ten 15-bit Hex values in ARG1 to ARG10 and the number of values in ARG N. An invalid Hex number or more than 10 items causes a return to BASIC with the contents of ARG1 being set to zero (for NAS-SYS 3 users).

The number of items is put into the B register as a counter then, using HL to step through the locations ARG1, etc, each Hex value is copied into the DE register and then exchanged into HL (2320-2370). A check is then made to see if the first bit of HL is set and if it is, the bits of HL are inverted (2000-2350). This gives the ones-complement, and the INC HL at 2460 then converts the value to the twos-complement. A minus sign is then printed. The current position of the numbers and the count are saved and the Hex number in HL is printed in decimal by the BASIC routine at F9AD Hex and a comma is then printed. The registers are retrieved with the position in HL and the looping continues. When the values have been printed, the printed string from 2550 to 2580 removes the last comma and shifts the line four places to the right to allow the word DATA to be put in. The cursor is set to the left-hand margin, ARG1 is zeroed and a jump to the input routine is made.

The input Hex values, if they are to be used in DOKE statements, should be entered as four digit numbers, with the bytes in reverse order. This needs to be done as the DOKE loads the memory with the low byte first, eg if your program starts DF 62 38 01, you must enter it as 62DF 0138, etc.

Adding Your Own Commands

A save to disc or read from disc routine (DSAVE, DLOAD) is an obvious choice for those with a disc drive. A RENUMBER is also an obvious addition — a version has appeared in Computing Today but this is not in a relative call form and would have to be modified if you want the code to be location independent. The only difficulty, once you have written your routine, is working out the offset to be included in the look-up table LTAB 2640-2670.

The keyword must be added to the end of the table, but you must set the first bit of the first character. This means if the first character was a D or 44 in Hex you would use C4. The table must end with 80 Hex.

If your code is put between the end of HEX (2630) and the start of LTAB (2640), you will have to adjust the values of LTAB and KEYWT accordingly.

Your routines should not touch 0800 to 0809 Hex or change 0C75 Hex or 0C7B Hex unless you are sure you want to!

When called, the new routines have the location after the end of their keyword available in the DE register. Your routines should finish with SCAL Z, a warm start to BASIC or a jump to the input routine.

Finally, I should like to describe the program's method of 'printing' messages, useful if you do not know where code is to be in memory. You set DE and BC to the destination and length of the message and then call the print routine. The first instruction of this POPs HL. This means you lose the return address but gain the start of the message; the LDIR then copies the message. When finished, HL points to the byte after the end of the message — where we wish to return — and a JP (HL) instruction allows the program to continue.

Program Listing

```
0C80                        ORG   $C80
0C80 0C 0B         ARGN     EQU   $C0B
0C80 0C 0C         ARG1     EQU   $C0C
0C80 0C 7B         UIN      EQU   $C7B
0C80 0C 29         CURLOC   EQU   $C29
0C80 10 78         PRISTO   EQU   $1078
0C80 0C 75         INTAB    EQU   $C75
0C80 08 05         KEYSTO   EQU   $805
0C80 08 03         FALST    EQU   $803
0C80 08 01         TABST    EQU   $801
0C80 EF 0C 00               DEFB  $EF,$C,0
0C83 67                     LD    H A
0C84 6F                     LD    L A
0C85 22 0C 0C               LD    (ARG1) HL
0C88 D7 00                  RCAL  FALS
0C8A E1            FALS     POP   HL
0C8B E5                     PUSH  HL
0C8C 22 03 08               LD    (FALST) HL
0C8F 11 49 00               LD    DE ITAB-FALS
0C92 19                     ADD   HL DE
0C93 22 75 0C               LD    (INTAB) HL
0C96 E1                     POP   HL
0C97 E5                     PUSH  HL
0C98 11 4B 00               LD    DE START-FALS
0C9B 19                     ADD   HL DE
0C9C 22 7B 0C               LD    (UIN) HL
0C9F AF                     XOR   A
0CA0 32 09 08               LD    ($809) A
0CA3 E1                     POP   HL
0CA4 E5                     PUSH  HL
0CA5 11 C1 01               LD    DE KEYWT-FALS
0CA8 19                     ADD   HL DE
0CA9 22 05 08               LD    (KEYSTO) HL
0CAC E1                     POP   HL
0CAD E5                     PUSH  HL
0CAE 11 B7 01               LD    DE LTAB-FALS-2
0CB1 19                     ADD   HL DE
0CB2 22 01 08               LD    (TABST) HL
0CB5 E1                     POP   HL
0CB6 EF                     DEFB  $EF
0CB7 57 61 72 60            DEFM  /Warm W/
     20 57
0CBD 0D                     DEFB  $D
0CBE 43 6F 6C 64            DEFM  /Cold C/
     20 43
0CC4 0D                     DEFB  $D
0CC5 00                     NOP
0CC6 CF            WAIT     DEFB  $CF
0CC7 FE 43                  CP    "C
0CC9 20 02                  JR    NZ WARM
0CCB DF 4A                  SCAL  "J
0CCD FE 57         WARM     CP    "W
0CCF 20 F5                  JR    NZ WAIT
0CD1 DF 5A                  SCAL  "Z
0CD3 76 00         ITAB     DEFB  $76,0
0CD5 DF 7D         START    SCAL  $7D
0CD7 D0                     RET   NC
0CD8 FE 0D                  CP    $D
0CDA 37                     SCF
0CDB C0                     RET   NZ
0CDC D9                     EXX
0CDD B7                     OR    A
0CDE 21 06 00               LD    HL 6
0CE1 ED 7A                  ADC   HL SP
0CE3 F9                     LD    SP HL
0CE4 DD E1                  POP   IX
0CE6 21 F8 FF               LD    HL -8
0CE9 ED 7A                  ADC   HL SP
0CEB F9                     LD    SP HL
0CEC D9                     EXX
0CED 37                     SCF
0CEE E5                     PUSH  HL
0CEF D5                     PUSH  DE
0CF0 C5                     PUSH  BC
0CF1 F5                     PUSH  AF
0CF2 11 D0 0B               LD    BE $BD0
0CF5 01 15 00               LD    BC $15
0CF8 D7 68                  RCAL  MESS
0CFA 54 6F 6F 6C            DEFM  /Toolkit by/
     6B 69 74 20
     62 79 20
0D05 57 20 53 20            DEFM  /W S Lounds/
     4C 6F 75 6E
     64 73
0D0F 2A 29 0C               LD    HL (CURLOC)
0D12 DD E5                  PUSH  IX
0D14 D1                     POP   DE
0D15 7E                     LD    A (HL)
```

```
0D16 BA                     CP    D
0D17 28 01                  JR    Z L1
0D19 72                     LD    (HL) D
0D1A 2B            L1       DEC   HL
0D1B 7E                     LD    A (HL)
0D1C B7                     OR    A
0D1D 20 FB                  JR    NZ L1
0D1F 23                     INC   HL
0D20 ED 5B 05 08            LD    DE (KEYSTO)
0D24 01 00 00               LD    BC 0
0D27 E5                     PUSH  HL
0D28 1A            L2       LD    A (DE)
0D29 FE 80                  CP    $80
0D2B 20 06                  JR    NZ NOTEND
0D2D E1                     POP   HL
0D2E F1                     POP   AF
0D2F C1                     POP   BC
0D30 D1                     POP   DE
0D31 E1                     POP   HL
0D32 C9                     RET
0D33 CB 7F         NOTEND   BIT   7 A
0D35 20 03                  JR    NZ COUNT
0D37 13            NEX      INC   DE
0D38 18 EE                  JR    L2
0D3A 0C            CONT     INC   C
0D3B E6 7F                  AND   $7F
0D3D BE            QQ       CP    (HL)
0D3E 28 04                  JR    Z NEXCHA
0D40 E1                     POP   HL
0D41 E5                     PUSH  HL
0D42 18 F3                  JR    NEX
0D44 23            NEXCHA   INC   HL
0D45 13                     INC   DE
0D46 1A                     LD    A (DE)
0D47 CB 7F                  BIT   7 A
0D49 20 02                  JR    NZ FOUND
0D4B 18 F0                  JR    QQ
0D4D EB            FOUND    EX    DE HL
0D4E 2A 01 08               LD    HL (TABST)
0D51 09                     ADD   HL BC
0D52 09                     ADD   HL BC
0D53 7E                     LD    A (HL)
0D54 23                     INC   HL
0D55 66                     LD    H (HL)
0D56 6F                     LD    L A
0D57 ED 4B 03 08            LD    BC (FALST)
0D5B 09                     ADD   HL BC
0D5C F1                     POP   AF
0D5D F1                     POP   AF
0D5E F1                     POP   AF
0D5F F1                     POP   AF
0D60 F1                     POP   AF
0D61 E9                     JP    (HL)
0D62 E1            MESS     POP   HL
0D63 ED B0                  LDIR
0D65 E9                     JP    (HL)
0D66 21 FD 10      OLD      LD    HL $10FD
0D69 23            L3       INC   HL
0D6A 7E                     LD    A (HL)
0D6B B7                     OR    A
0D6C 20 FB                  JR    NZ L3
0D6E 23                     INC   HL
0D6F 22 FA 10               LD    ($10FA) HL
0D72 5E            L4       LD    E (HL)
0D73 23                     INC   HL
0D74 56                     LD    D (HL)
0D75 BA                     CP    D
0D76 EB                     EX    DE HL
0D77 20 F9                  JR    NZ L4
0D79 EB                     EX    DE HL
0D7A 23                     INC   HL
0D7B 22 D6 10               LD    ($10D6) HL
0D7E DF 6A                  SCAL  $6A
0D80 DF 5A                  SCAL  "Z
0D82 EB            DECHEX   EX    DE HL
0D83 2B                     DEC   HL
0D84 CD 36 E8               CALL  $E836
0D87 38 02                  JR    C CHA
0D89 DF 5A         BAC      SCAL  "Z
0D8B CD A5 E9      CHA      CALL  $E9A5
0D8E EB                     EX    DE HL
0D8F DF 6A                  SCAL  $6A
0D91 DF 66                  SCAL  $66
0D93 DF 6A                  SCAL  $6A
0D95 18 F2                  JR    BAC
0D97 11 78 10      DUMP     LD    DE PRISTO
0D9A 01 0B 00               LD    BC $B
0D9D D7 C3                  RCAL  MESS
0D9F 22 5A 20 20            DEFM  /"Z  =";Z /
     3D 22 3B 5A
     20 20
0DA9 00                     NOP
0DAA 2A D6 10               LD    HL ($10D6)
0DAD DF 6A                  SCAL  $6A
0DAF ED 5B D8 10   LOOP     LD    DE ($10D8)
```

```
ØDB3 B7                     OR   A
ØDB4 ED 52                  SBC  HL DE
ØDB6 19                     ADD  HL DE
ØDB7 38 Ø4                  JR   C CARON
ØDB9 DF 6A                  SCAL $6A
ØDBB DF 5A                  SCAL "Z
ØDBD CB 7E        CARON     BIT  7 (HL)
ØDBF 3E 2Ø                  LD   A "
ØDC1 28 Ø2                  JR   Z NOTST
ØDC3 3E 24                  LD   A "$
ØDC5 32 7B 1Ø     NOTST     LD   (PRISTO+3) A
ØDC8 32 81 1Ø               LD   (PRISTO+9) A
ØDCB 7E                     LD   A (HL)
ØDCC CB BF                  RES  7 A
ØDCE B7                     OR   A
ØDCF 2Ø Ø2                  JR   NZ TWOVAR
ØDD1 3E 2Ø                  LD   A "
ØDD3 32 7A 1Ø     TWOVAR    LD   (PRISTO+2) A
ØDD6 32 8Ø 1Ø               LD   (PRISTO+8) A
ØDD9 23                     INC  HL
ØDDA 7E                     LD   A (HL)
ØDDB 32 79 1Ø               LD   (PRISTO+1) A
ØDDE 32 7F 1Ø               LD   (PRISTO+7) A
ØDE1 E5                     PUSH HL
ØDE2 21 78 1Ø               LD   HL PRISTO
ØDE5 B7                     OR   A
ØDE6 CD 23 EB               CALL $EB23
ØDE9 CD 66 E8               CALL $E866
ØDEC E1                     POP  HL
ØDED 23                     INC  HL
ØDEE 23                     INC  HL
ØDEF 23                     INC  HL
ØDFØ 23                     INC  HL
ØDF1 23                     INC  HL
ØDF2 18 BB                  JR   LOOP
ØDF4 DF 79        HEX       SCAL $79
ØDF6 Ø8                     EX   AF AF'
ØDF7 DF 6A                  SCAL $6A
ØDF9 Ø8                     EX   AF AF'
ØDFA 3Ø Ø8                  JR   NC OK
ØDFC 21 ØØ ØØ     NOK       LD   HL Ø
ØDFF 22 ØC ØC               LD   (ARG1) HL
ØEØ2 DF 5A                  SCAL "Z
ØEØ4 3A ØB ØC     OK        LD   A (ARGN)
ØEØ7 B7                     OR   A
ØEØ8 28 F2                  JR   Z NOK
ØEØA 47                     LD   B A
ØEØB 21 ØC ØC               LD   HL ARG1
ØEØE 5E           LOOPH     LD   E (HL)
ØEØF 23                     INC  HL
ØE1Ø 56                     LD   D (HL)
ØE11 23                     INC  HL
ØE12 EB                     EX   DE HL
ØE13 CB 7C                  BIT  7 H
ØE15 28 ØA                  JR   Z PRTNO
ØE17 7C                     LD   A H
ØE18 2F                     CPL
ØE19 67                     LD   H A
ØE1A 7D                     LD   A L
ØE1B 2F                     CPL
ØE1C 6F                     LD   L A
ØE1D 23                     INC  HL
ØE1E EF 2D ØØ               DEFB $EF,"-,Ø
ØE21 D5           PRTNO     PUSH DE
ØE22 C5                     PUSH BC
ØE23 CD AD F9               CALL $F9AD
ØE26 EF 2C ØØ               DEFB $EF,",,Ø
ØE29 C1                     POP  BC
ØE2A E1                     POP  HL
ØE2B 1Ø E1                  DJNZ LOOPH
ØE2D EF Ø8 17               DEFB $EF,8,$17
ØE3Ø 16 16 16 16            DEFB $16,$16,$16,$16
ØE34 44 41 54 41            DEFM /DATA/
ØE38 17 ØØ                  DEFB $17,Ø
ØE3A 67                     LD   H A
ØE3B 6F                     LD   L A
ØE3C 22 ØC ØC               LD   (ARG1) HL
ØE3F 2A 7B ØC               LD   HL ($C7B)
ØE42 E9                     JP   (HL)
ØE43 DC ØØ        LTAB      DEFW OLD-FALS
ØE45 F8 ØØ                  DEFW DECHEX-FALS
ØE47 6A Ø1                  DEFW HEX-FALS
ØE49 ØD Ø1                  DEFW DUMP-FALS
ØE4B CF 4C 44     KEYWT     DEFB $8Ø+"O,"L,"D
ØE4E C4 45 43               DEFB $8Ø+"D,"E,"C
ØE51 C8 45 58               DEFB $8Ø+"H,"E,"X
ØE54 C4 55 4D               DEFB $8Ø+"D,"U,"M
ØE57 8Ø                     DEFB $8Ø
```

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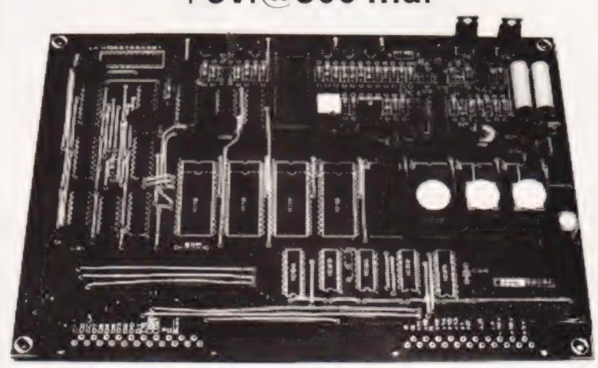

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PUZZLE SQUARE

Fed up with cubes? Move on to squares...

Andrew Thomas

This program is based on the popular game in which one tries to re-arrange the numbered tiles of the puzzle to read 1-15 consecutively. Written in a fairly standard BASIC, the program should run on most machines supporting 4K or more of memory.

The computer may take up to 20 seconds to set up the puzzle; this delay is due to the set-up procedure necessary to avoid impossible puzzles. The computer will state the maximum number of moves it should take to solve the puzzle although it will sometimes be possible to complete the puzzle in fewer moves.

Replying to the question 'WHAT IS YOUR MOVE?', the player must specify first the direction of the move (Left, Right, Up or Down) and second, the number of pieces to be moved (three is the maximum). For convenience, only the first letter of the direction need be typed in and if the number of pieces to move is zero or non-existent, the computer will assume you wish to move as many as possible. Note the numbers move in the direction stated and not the space — if you find this confusing change line 250 to A$= "RLDU" as this will reverse the direction of movement.

The computer will then check to see if the puzzle has been completed and if not, print the puzzle out again (assuming the last move made was valid).

How It Works

For those of you interested in the way the program actually works, the following might prove useful. The puzzle is stored in the 16 element array, A0, and the space is represented as a zero. P has been designated the position of the space in the array, N is the number of pieces to move and D represents the direction in which the pieces move.

Moving on to the listing itself, lines 310-450 set up the puzzle, it is printed out by lines 490-650 and the two lines, 660 and 670, check if the puzzle has been completed. The rest of the program is concerned with movement; lines 720-740 find the numeric equivalent to the direction chosen, lines 810-820 check the move vertically, lines 980-990 check the move horizontally and lines 920-960 actually move the pieces.

```
****** SAMPLE RUN ******

+---------------------+
!                     !
!        1    2    3  !
!                     !
!   5    6    7    4  !
!                     !
!   9   10   11    8  !
!                     !
!  13   14   15   12  !
!                     !
+---------------------+
MOVE NUMBER  16
WHAT IS YOUR MOVE LEFT 2

+---------------------+
!                     !
!   1    2         3  !
!                     !
!   5    6    7    4  !
!                     !
!   9   10   11    8  !
!                     !
!  13   14   15   12  !
!                     !
+---------------------+
MOVE NUMBER  17
WHAT IS YOUR MOVE R1

+---------------------+
!                     !
!   1         2    3  !
!                     !
!   5    6    7    4  !
!                     !
!   9   10   11    8  !
!                     !
!  13   14   15   12  !
!                     !
+---------------------+
MOVE NUMBER  18
WHAT IS YOUR MOVE L

+---------------------+
!                     !
!   1    2    3       !
!                     !
!   5    6    7    4  !
!                     !
!   9   10   11    8  !
!                     !
!  13   14   15   12  !
!                     !
+---------------------+
MOVE NUMBER  19
WHAT IS YOUR MOVE U

+---------------------+
!                     !
!   1    2    3    4  !
!                     !
!   5    6    7    8  !
!                     !
!   9   10   11   12  !
!                     !
!  13   14   15       !
!                     !
+---------------------+
WELL DONE .
YOU TOOK  19 MOVES TO COMPLETE THE PUZZLE .
THE PUZZLE COULD HAVE BEEN SOLVED IN  16 MOVES .
DO YOU WANT ANOTHER GAME PLAY AGAIN SOME TIME !!
READY.
```

Program Listing

```
7     REM WRITTEN ON APRIL 1980 WRITTEN ON THE
      'SORCERER'
10    DIM A(16),D(4)
20    PRINTCHR$(12);TAB(26)"NUMBER PUZZLE"
30    PRINTAB(26)"[13 - ]"
40    PRINT
50    PRINT
60    PRINT"THIS PROGRAM IS A COMPUTER VERSION OF THE
      POPULAR"
70    PRINT"NUMBER PUZZLE"
80    PRINT
90    PRINT"THE OBJECT OF THE GAME IS TO REARRANGE THE
      PUZZLE"
100   PRINT"SO THAT IT READS 1-15 IN SEQUENCE, WITH 1 AT
      TOP LEFT"
110   PRINT"AND THE SPACE AT BOTTOM RIGHT."
120   PRINT
130   PRINT"WHEN ASKED 'WHAT IS YOUR MOVE' YOU INPUT
      THE DIRECTION"
140   PRINT"IN WHICH YOU WANT TO MOVE THE NUMBERS
      AND OPPISITE"
150   PRINT"DIRECTION YOU WANT TO MOVE THE SPACE."
160   PRINT"THE DIRECTIONS ARE 'RIGHT', 'LEFT', 'UP' AND
      'DOWN'."
170   PRINT" FOR CONVENIENCE ONLY THE FIRST LETTER IS
      NEEDED."
180   PRINT"BEFORE HITTING 'RETURN' INPUT ALSO THE
      NUMBER THAT YOU"
190   PRINT"WANT TO MOVE. IF YOU INPUT '0' THE PROGRAM
      WILL ASSUME"
200   PRINT"YOU WANT TO MOVE AS MANY AS POSSIBLE."
210   PRINT"THE MAXIMUM YOU CAN MOVE IN ONE GO IS '3'."
220   PRINT
230   PRINT"THE PROGRAM WILL VALIDATE YOUR MOVE."
240   PRINT
250   A$="LRUD"
260   M=0
270   D(1)=-1
280   D(2)=1
290   D(3)=-4
300   D(4)=4
310   FOR I=1 TO 15
320   A(I)=I
330   NEXT I
340   A(16)=0
350   P=16
360   R=INT(RND(1)*10)+12
370   FOR W=1 TO R
380   S=0
390   N=INT(RND(1)*3)+1
400   IF ABS(D)=4 THEN D=D(INT(RND(1)*2)+1): GOTO 420
410   D=D(INT(RND(1)*2)+3)
420   GOSUB 820
430   IF N<>0 AND S=1 THEN N=0 : S=0 : GOTO 420
440   IF N=0 AND S=1 THEN S=0 : D=-D : GOTO 420
450   NEXT W
460   PRINT
470   INPUT" HIT 'RETURN' TO CONTINUE ";Q$
480   W=0
490   PRINT
500   PRINT"HERE IS THE PUZZLE IT CAN BE SOLVED IN
      ";R;"MOVES."
510   PRINT
520   PRINT"[+][20 - ][+]"
530   PRINT"[!][20 SPC][!]"
540   M=M=+1
550   FOR I=0 TO 12 STEP 4
560   PRINT"!";
570   FOR J=1 TO 4
580   IF A(I+J)=0 THENPRINT"[4 SPC]";:P=I+J : GOTO 610
590   IF A(I+J)<10 THENPRINT"[4 SPC]";A(I+J); : GOTO 610
600   PRINT"[2 SPC]";A(I+J);
610   NEXT J
620   PRINT"!"
630   PRINT"[!][20 SPC][!]"
640   NEXT I
650   PRINT"[+][20 - ][+]"
660   FOR I=1 TO 15
670   IF A(I)=I THEN NEXT I : GOTO 1040
680   PRINT
690   PRINT"MOVE NUMBER ";M;
700   INPUT"WHAT IS YOUR MOVE";Q$
710   PRINT
720   FOR I=1 TO 4
730   IF LEFT$(Q$,1)=MID$(A$,I,1) THEN 780
740   NEXT I
750   PRINT"ENTRY FORMAT INCORRECT."
760   PRINT"NOW ";
770   GOTO 700
780   D=D(I)
790   GOSUB 810
800   GOTO 520
810   N=VAL(RIGHT$(Q$,1))
820   IFP-(D*N)>0ANDP-(D*N)<17ANDP-D>0ANDP-D<17 THEN
      870
830   IF W<>0 THEN S=1 : RETURN
840   PRINT"MOVE IS INVALID."
850   PRINT"NOW";
860   GOTO 700
870   C=1
880   IF ABS(D)=1THEN 980
890   IF N<>0 THEN 920
900   IFP-(C*D)>0ANDP-(C*D)<17THEN C=C+1 : GOTO 900
910   N=C-1
920   FOR I=1 TO N
930   A(P)=A(P-D)
940   A(P-D)=0
950   P=P-D
960   NEXT I
970   RETURN
980   E=INT((P-1)/4)*4+1
990   IF P-(N*D)<EOR P-(N*D)>E+3 OR P-D<E OR P-D>E+3
      THEN 830
1000  IF N<>0 THEN 920
1010  IF P-(C*D)>=E AND P-(C*D)<E +4 THEN C=C+1 :
      GOTO1010
1020  N=C-1
1030  GOTO 920
1040  M=M-1
1050  IF M<=RTHEN PRINT"WOW!! OUTSTANDING
      PERFORMANCE !!!!!":GOTO1090
1060  IF M<R*2 THENPRINT"WELL DONE.":GOTO1090
1070  IF M<R*4 THENPRINT"AVERAGE
      PERFORMANCE.":GOTO1090
1080  PRINT"YOU NEED MORE PRACTISE !!!!"
1090  PRINT"YOU TOOK ";M;"MOVES TO COMPLETE THE
      PUZZLE."
1100  PRINT"THE PUZZLE COULD HAVE BEEN SOLVED IN
      ";R;"MOVES."
1110  PRINT
1120  INPUT"DO YOU WANT ANOTHER GAME":Q$
1130  IF LEFT$(Q$,1)="Y"THEN 20
1140  PRINT"PLAY AGAIN SOME TIME !!"
1150  END
```

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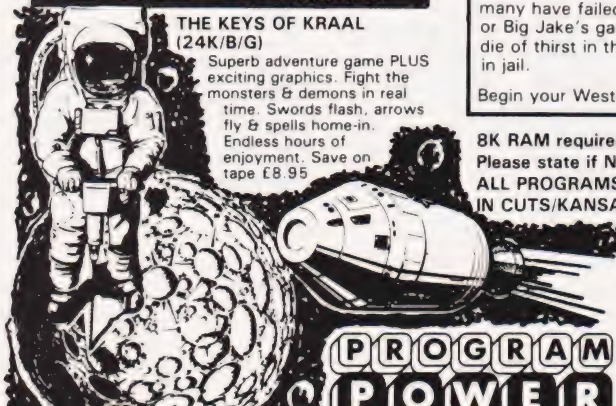

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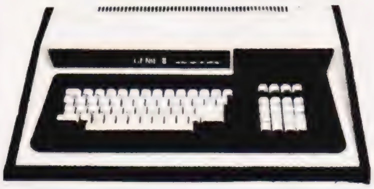

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There are also semi-regular tesselations, which can include two or more regular polygons. The criterion for their use being that combinations of the angles of the polygons must add up to 360 degrees at any point at which the polygons meet. A combination of squares and regular octagons will fill a surface completely as long as two octagons (angle 135 degrees and one square (90 degrees) meet at a point.

tionship to a square. However, the new shape will still cover a plane surface when repeated as illustrated in Fig. 2a and b.

If the square is turned through 45 degrees, so that it now looks like a diamond, a similar series of alterations may be made as can be seen in Fig. 3 and Fig. 4.

For a triangular base, there is one change in the method employed. The area subtracted has to be inverted before being added to the adjacent side of the triangle as shown in Fig. 5. The resulting patterns can then be repeated to cover a plane surface as illustrated in Fig. 6. The high resolution screen of the Apple will illustrate the development of the 'tiles' as they are formed, once the original square or triangular base is laid down.

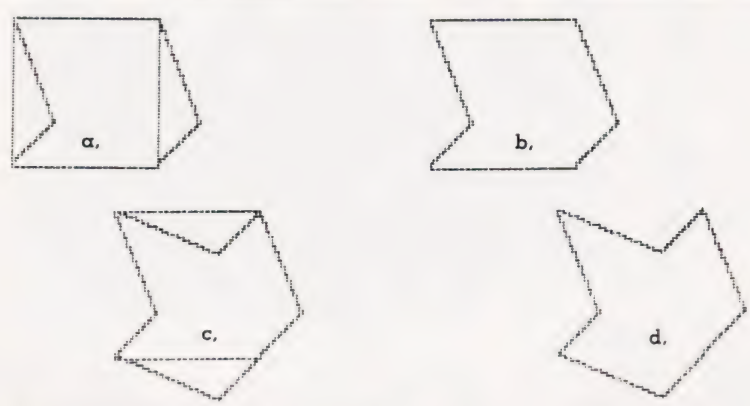


Fig. 1. The symmetrical alteration of a square.

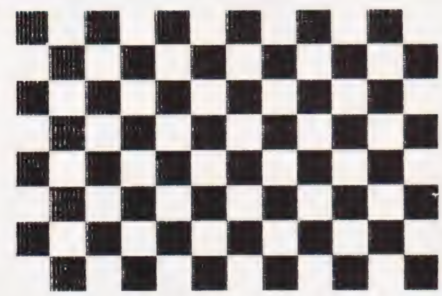


Fig. 2. The before and after tile patterns bas

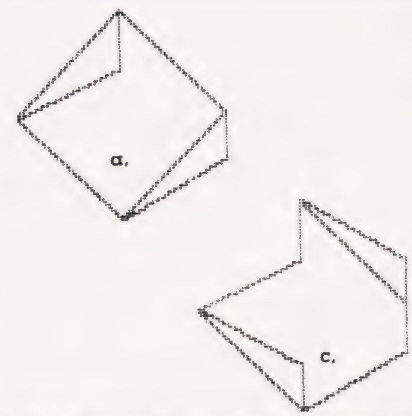


Fig. 3. A diamond shape can be altered in the

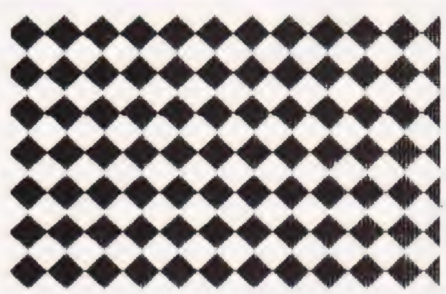


Fig. 4. ...giving these results.

On The Tiles

By following simple rules, we can adapt the regular tesselations to designs, sometimes called 'tile patterns'. This is because a set of tiles, all cut to the same shape, will completely cover the floor.

Consider the simplest shape to start with — a square. When a piece of a square is removed from one side of a square, an identical piece must be added to the outside of the opposite edge of the square (see Figs. 1a and b). The new shape thus formed will fit into an identical shape and has the same area as the original square. Similar alterations to the remaining sides of the square, (see Figs 1c and d), will leave a shape which bears little visual rela-

The co-ordinates of the points to be removed are typed in from the keyboard. On the screen, the given point will be removed, and the replacement added, so that the changing shape is always visible.

```
250  VTAB:PRINT "CO-ORDINATES":
     INPUT X,Y
260  IF X=0 AND Y=0 THEN 300
270  P1(I)=X:Q1(I)=Y:P2(I)=X+16
280  VTAB Y:HTAB X:PRINT " ":
     VTAB Y:HTAB(X+16):PRINT "+"
290  I=I+1:IF I<89 THEN 250
295  HOME:PRINT "YOU HAVE 88 POINTS
     AND THE PATTERN IS ASSUMED
     COMPLETE"
```

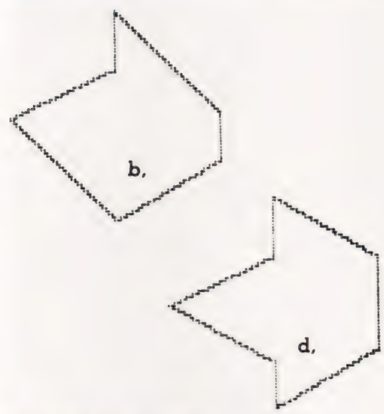
The co-ordinates are stored in arrays P1(I) and Q1(I), thus restricting the number of possible points to 88. The x co-ordinate of the new point is found by adding 16 to the P1(I), while the y co-ordinate stays the same. The number (N) of points used is then carried forward to the pattern-making program.

```
320  FOR J=0 TO 5:FOR K=0 TO 3:
     FOR M=9 TO 24:HPLOT J*32+9,
     K*32+M TO J*32+24,K*32+M:
     HPLOT J*32+25,K*32+M+16 TO
     J*32+40,K*32+M+16:
     NEXT M:NEXT K:NEXT J
```

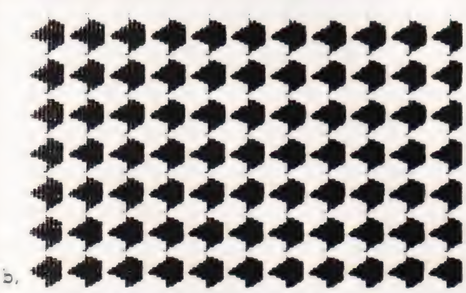
The basic square pattern is illustrated in alternative black and white squares (Fig. 2a).

Once the square pattern is completed, the points are moved one by one across the screen by plotting the points to be erased with HCOLOR=0 and the replacement point with HCOLOR=3, (Fig. 2b).

...n a square.



...me way as the square...




```
330  FOR I=1 TO N:FOR J=0 TO 5:
     FOR K=0 TO 3:HCOLOR=0:
     HPLOT 8+J*32+P1(I),
     K*32+8+Q1(I):
     HPLOT J*32+24+P1(I),
     K*32+24+Q1(I)
340  HCOLOR=3:HPLOT J*32+8+P2(I),
     K*32+8+Q1(I):
     HPLOT J*32-8+P2(I),
     K*32+Q1(I)+24:
     NEXT K:NEXT J:NEXT I
```

A Girl's Best Friend

The diamond shape has diagonals 17 points long. The co-ordinates still have their origin at enclosing square so that a little care is needed to make sure that the co-ordinates given are in the square itself.

The co-ordinates taken in are placed in the array P1 and Q1. The

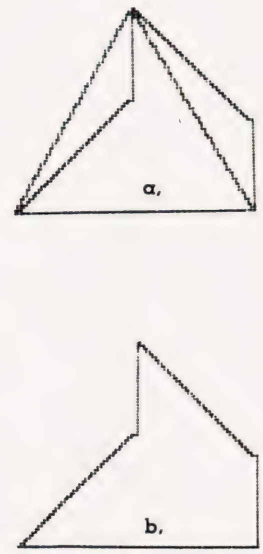


Fig. 5. A triangular tile requires slightly more care.

the top left-hand corner of the x co-ordinate of the replacement point, P2, is found by adding 8 to x and checking whether the value is greater than 17. In a similar way, the y co-ordinate, Q2, is found by subtracting 9 from y and checking that the value is not less than 1.

```
560  VTAB 18:PRINT "CO-ORDINATES ":
     INPUT X,Y
570  IF X=0 AND Y=0 THEN 600
580  P1(I)=X:Q1(I)=Y:P2(I)=X+8:
     Q2(I)=Q1(I)-9
590  IF X>9 THEN P2(I)=P2(I)-17
600  IF Y<9 THEN Q2(I)=Q2(I)+18
610  VTAB Y:HTAB X:PRINT " "
620  P=Y-9:IF P<1 THEN P=P+18
630  Q=X+9:IF Q>19 THEN Q=Q-18
640  VTAB P:HTAB Q:PRINT "+"
650  I=I+1:IF I<89 THEN 560
655  HOME:PRINT "YOU HAVE 88 POINTS
     AND THE PATTERN IS ASSUMED
     COMPLETE"
660  N=I-1:HGR:HCOLOR=3
680  FOR J=0 TO 10:FOR K=0 TO 7:
     FOR R=0 TO 8:
     HPLOT J*17+(9-R),K*18+R+1 TO
     J*17+9+R,K*18+R+1:NEXT R
690  FOR R=7 TO 0 STEP -1:
     HPLOT J*17+9-R,K*18+17-R TO
     J*17+9+R,K*18+17-R:NEXT R
700  NEXT K:NEXT J
710  FOR I=1 TO N:FOR J=0 TO 10:
     FOR K=0 TO 7
720  HCOLOR=0:HPLOT J*17+P1(I),
     K*18+Q1(I)
730  HCOLOR=3:P=J*17+P2(I):
     IF P>270 THEN P=P-270
740  Q=K*18+Q2(I):IF Q>145 THEN
     Q=Q-144
750  HPLOT P,Q:NEXT K:NEXT J:NEXT I:
     GOSUB 780:GOTO 20
```

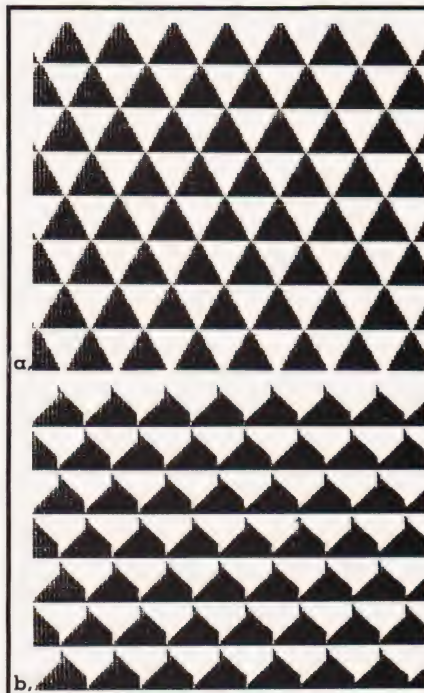


Fig. 6. The results are just as pretty though.

The diamond base is printed out as above and then the points are moved as in the square (Fig. 4a and b).

A Tile From Bermuda?

An equilateral triangle is not very easy to illustrate on the 25 by 40 screen. When the points are translated onto the high resolution screen, the triangular network is recognisable, although the edges are slightly blurred, see Fig. 6a.

The triangle used to design the changed shape does, however, look rather strange. It has a vertical height of 20 points and a horizontal base of 23 points. The co-ordinates are based on the surrounding square as before, so that the top vertex is the point (12,1), and the ends of the base are (1,20) and (23,20).

Once the element is complete, drawing the triangular base on the high resolution graphics screen is a

```
(1,1)          (16,1)
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
 ++++++++++++++++
(1,16)         (16,16)
```

The square base pattern.

```
          (9,1)

            +
           +++
          +++++
         +++++++
        +++++++++
       +++++++++++
      +++++++++++++
     +++++++++++++++
(1,9) +++++++++++++++++ (17,9)
     +++++++++++++++
      +++++++++++++
       +++++++++++
        +++++++++
         +++++++
          +++++
           +++
            +

          (9,17)
```

The diamond base pattern.

rather longer process than for the previous two examples. This is because of the more irregular length of the horizontal lines used to draw each triangle. The program is found in lines 3290 to 3790.

Once the base is drawn, the changes are made quite easily because the co-ordinate system is still based on rectangular axes (Fig. 6a and b).

```
3280  FOR I=1 TO N:FOR J=0 TO 8:
      FOR K=0 TO 3
3830  HCOLOR=0:HPLOT J*24+P1(I),
      K*40+Q1(I):
      HPLOT J*24+P1(I)+12,
      K*40+Q1(I)+20
3840  HCOLOR=3:HPLOT J*24+P2(I),
      K*40+Q2(I):
      HPLOT J*24+P2(I)+12,
      K*40+Q2(I)+20:
      NEXT K:NEXT J:NEXT I
```

The program for the triangular-based tiles has been given separately from the square and diamond shape tiles to avoid any difficulties when using discs with the HGR screen. As they stand, they will fit without trouble into an Apple with discs and 48K of memory.

```
           (12,1)

             +
            +++
           +++++
           +++++
          +++++++
          +++++++
         +++++++++
         +++++++++
        +++++++++++
       +++++++++++++
       +++++++++++++
      +++++++++++++++
      +++++++++++++++
     +++++++++++++++++
     +++++++++++++++++
    +++++++++++++++++++
    +++++++++++++++++++
   +++++++++++++++++++++
   +++++++++++++++++++++
  +++++++++++++++++++++++
(1,20)                (23,20)
```

The triangular base pattern.

Program Listing

```
5   DIM P1(88),P2(88),01(88),02(88)
6   HOME : VTAB 6: HTAB 7: PRINT "**********************
7   HTAB 7: PRINT "*                    *"
8   HTAB 7: PRINT "*  TILE  PATTERNS    *"
9   HTAB 7: PRINT "*                    *"
10   HTAB 7: PRINT "*   G.H.GALLAGHER    *"
11   HTAB 7: PRINT "*                    *"
12   HTAB 7: PRINT "*      1982          *"
13   HTAB 7: PRINT "*                    *"
14   HTAB 7: PRINT "**********************"
15   FOR I = 1 TO 2000: NEXT
20   TEXT : HOME : PRINT "TYPE 1 FOR SQUARE BASE
30   PRINT "     2 FOR DIAMOND BASE"
60   PRINT "     3 TO END"
70   INPUT A: ON A GOTO 80,380,370
80   HOME : PRINT "+++++++++++++++++"
90   PRINT "+++++++++++++++++"
100  PRINT "+++++++++++++++++"
110  PRINT "+++++++++++++++++"
120  PRINT "+++++++++++++++++"
130  PRINT "+++++++++++++++++"
140  PRINT "+++++++++++++++++"
150  PRINT "+++++++++++++++++"
160  PRINT "+++++++++++++++++"
170  PRINT "+++++++++++++++++"
180  PRINT "+++++++++++++++++"
190  PRINT "+++++++++++++++++"
200  PRINT "+++++++++++++++++"
210  PRINT "+++++++++++++++++"
220  PRINT "+++++++++++++++++"
230  PRINT "+++++++++++++++++"
240 I = 1
250  VTAB 18: PRINT "CO-ORDINATES": INPUT X,Y
260  IF X = 0 AND Y = 0 THEN 300
270 P1(I) = X:Q1(I) = Y:P2(I) = X + 16
280  VTAB Y: HTAB X: PRINT " ": VTAB Y: HTAB (X + 16): PRINT "+"
290 I = I + 1: IF I < 89 THEN 250
295  HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS      ASSUMED TO BE C
     OMPLETE
300  HGR : HCOLOR= 3:N = I - 1
320  FOR J = 0 TO 5: FOR K = 0 TO 3: FOR M = 9 TO 24: HPLOT J * 32 + 9,K *
     32 + M TO J * 32 + 24,K * 32 + M: HPLOT J * 32 + 25,K * 32 + M + 16 TO
     J * 32 + 40,K * 32 + M + 16: NEXT M: NEXT K: NEXT J
330  FOR I = 1 TO N: FOR J = 0 TO 5: FOR K = 0 TO 3: HCOLOR= 0: HPLOT 8 +
     J * 32 + P1(I),K * 32 + 8 + Q1(I): HPLOT J * 32 + 24 + P1(I),K * 32 +
     24 + Q1(I)
340  HCOLOR= 3: HPLOT J * 32 + 8 + P2(I),K * 32 + 8 + Q1(I): HPLOT J * 32 -
     8 + P2(I),K * 32 + Q1(I) + 24: NEXT K: NEXT J: NEXT I
350  GOSUB 780
360  GOTO 20
370  END
380  HOME : PRINT "        +        "
390  PRINT "       +++       "
400  PRINT "      +++++      "
410  PRINT "     +++++++     "
420  PRINT "    +++++++++    "
430  PRINT "   +++++++++++   "
440  PRINT "  +++++++++++++  "
450  PRINT " +++++++++++++++  "
460  PRINT "+++++++++++++++++ "
470  PRINT " +++++++++++++++  "
480  PRINT "  +++++++++++++   "
490  PRINT "   +++++++++++    "
500  PRINT "    +++++++++     "
510  PRINT "     +++++++      "
520  PRINT "      +++++       "
530  PRINT "       +++        "
540  PRINT "        +         "
550 I = 1
560  VTAB 18: PRINT "CO-ORDINATES": INPUT X,Y
570  IF X = 0 AND Y = 0 THEN 660
580 P1(I) = X:Q1(I) = Y:P2(I) = X + 8:Q2(I) = Q1(I) - 9
590  IF X > 9 THEN P2(I) = P2(I) - 17
600  IF Y < 9 THEN Q2(I) = Q2(I) + 18
610  VTAB Y: HTAB X: PRINT " "
620 P = Y - 9: IF P < 1 THEN P = P + 18
630 Q = X + 9: IF Q > 18 THEN Q = Q - 18
640  VTAB P: HTAB Q: PRINT "+"
650 I = I + 1: IF I < 89 THEN 560
660  HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS      ASSUMED TO BE C
     OMPLETE."
670 N = I - 1: HGR : HCOLOR= 3
680  FOR J = 0 TO 14: FOR K = 0 TO 7: FOR R = 0 TO 8: HPLOT J * 17 + (9 -
     R),K * 18 + R + 1 TO J * 17 + 9 + R,K * 18 + R + 1: NEXT R
690  FOR R = 7 TO 0 STEP - 1: HPLOT J * 17 + 9 - R,K * 18 + 17 - R TO J *
     17 + 9 + R,K * 18 + 17 - R: NEXT R
700  NEXT K: NEXT J
710  FOR I = 1 TO N: FOR J = 0 TO 14: FOR K = 0 TO 7
720  HCOLOR= 0: HPLOT J * 17 + P1(I),K * 18 + Q1(I)
730  HCOLOR= 3:P = J * 17 + P2(I): IF P > 270 THEN P = P - 270
740 Q = K * 18 + Q2(I): IF Q > 145 THEN Q = Q - 144
750  HPLOT P,Q: NEXT K: NEXT J: NEXT I: GOSUB 780: GOTO 20
780  VTAB 21: PRINT "PRESS ANY KEY TO CONTINUE"
790  GET A$: IF A$ = "" THEN 790
800  RETURN
```

```
10  DIM P1(88),P2(88),Q1(88),Q2(88)
2900  HOME : VTAB 6: HTAB 7: PRINT "**********************"
2910  HTAB 7: PRINT "*                    *"
2920  HTAB 7: PRINT "* TRIANGULAR BASED   *"
2930  HTAB 7: PRINT "*        TILES       *"
2940  HTAB 7: PRINT "*                    *"
2950  HTAB 7: PRINT "*   G.H.GALLAGHER    *"
2960  HTAB 7: PRINT "*        1982        *"
2970  HTAB 7: PRINT "*                    *"
2980  HTAB 7: PRINT "**********************"
2990  FOR I = 1 TO 2000: NEXT
3000  REM :TRIANGLE
3010  HOME : PRINT "           +           "
3020  PRINT "          +++          "
3030  PRINT "         +++++         "
3040  PRINT "         +++++         "
3050  PRINT "        +++++++        "
3060  PRINT "        +++++++        "
3070  PRINT "       +++++++++       "
3080  PRINT "       +++++++++       "
3090  PRINT "      +++++++++++      "
3100  PRINT "     +++++++++++++     "
3110  PRINT "     +++++++++++++     "
3120  PRINT "    +++++++++++++++    "
3130  PRINT "    +++++++++++++++    "
3140  PRINT "   +++++++++++++++++   "
3150  PRINT "   +++++++++++++++++   "
3160  PRINT "  +++++++++++++++++++  "
3170  PRINT "  +++++++++++++++++++  "
3180  PRINT " +++++++++++++++++++++ "
3190  PRINT " +++++++++++++++++++++ "
3200  PRINT "+++++++++++++++++++++++"
3210 I = 1
3220  VTAB 21: PRINT "CO-ORDINATES": INPUT X,Y
3230  IF X = 0 OR Y = 0 THEN 3280
3240 P1(I) = X:Q1(I) = Y:Q2(I) = 21 - Y:P2(I) = 12 + X
3250  VTAB Y: HTAB X: PRINT " "
3260  VTAB Q2(I): HTAB P2(I): PRINT "+"
3270 I = I + 1: IF I < 89 THEN 3220
3275  HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS      ASSUMED TO BE
    COMPLETE."
3280 N = I - 1: HGR : HCOLOR= 3
3290  FOR J = 0 TO 8: FOR K = 0 TO 3
3300 P = 24 * J + 12:Q = 40 * K + 1: GOSUB 3880: HPLOT P,Q
3320 P = 24 * J + 13:Q = 40 * K + 2: GOSUB 3880: HPLOT 24 * J + 11,Q TO P,
    Q
3340 P = 24 * J + 14:Q = 40 * K + 4: GOSUB 3880: HPLOT 24 * J + 10,Q - 1 TO
    P,Q - 1
3360  HPLOT 24 * J + 10,Q TO P,Q:P = 24 * J + 15:Q = 40 * K + 6: GOSUB 388
    0: HPLOT 24 * J + 9,Q - 1 TO P,Q - 1
3390  HPLOT 24 * J + 9,Q TO P,Q:P = 24 * J + 16:Q = 40 * K + 8: GOSUB 3880

3410  HPLOT J * 24 + 8,Q - 1 TO P,Q - 1: HPLOT J * 24 + 8,Q TO P,Q:P = 24 *
    J + 17:Q = 40 * K + 9: GOSUB 3880
3430  HPLOT 24 * J + 7,Q TO P,Q:P = 24 * J + 18:Q = 40 * K + 11: GOSUB 388
    0: HPLOT 24 * J + 6,Q - 1 TO P,Q - 1: HPLOT 24 * J + 6,Q TO P,Q
3460 P = 24 * J + 19:Q = 40 * K + 13: GOSUB 3880: HPLOT 24 * J + 5,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 5,Q TO P,Q
3480 P = 24 * J + 20:Q = 40 * K + 15: GOSUB 3880: HPLOT 24 * J + 4,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 4,Q TO P,Q
3500 P = 24 * J + 21:Q = 40 * K + 17: GOSUB 3880: HPLOT 24 * J + 3,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 3,Q TO P,Q
3520 P = 24 * J + 22:Q = 40 * K + 19: GOSUB 3880: HPLOT 24 * J + 2,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 2,Q TO P,Q
3540 P = 24 * J + 23:Q = 40 * K + 20: GOSUB 3880: HPLOT 24 * J + 1,Q TO P,
    Q
3560 P = 24 * J + 24:Q = 40 * K + 21: GOSUB 3880: HPLOT P,Q: HPLOT 24 * J +
    23,K * 40 + 22 TO 24 * J + 25,K * 40 + 22
3590 P = 24 * J + 26:Q = 40 * K + 24: GOSUB 3880: HPLOT 24 * J + 22,Q - 1 TO
    P,Q - 1
3610  HPLOT 24 * J + 22,Q TO P,Q:P = 24 * J + 27:Q = 40 * K + 26: GOSUB 38
    80: HPLOT 24 * J + 21,Q - 1 TO P,Q - 1
3640  HPLOT 24 * J + 21,Q TO P,Q:P = 24 * J + 28:Q = 40 * K + 28: GOSUB 38
    80: HPLOT J * 24 + 20,Q - 1 TO P,Q - 1: HPLOT J * 24 + 20,Q TO P,Q
3670 P = 24 * J + 29:Q = 40 * K + 29: GOSUB 3880: HPLOT 24 * J + 19,Q TO P
    ,Q:P = 24 * J + 30:Q = 40 * K + 31: GOSUB 3880
3680  HPLOT 24 * J + 19,Q TO P,Q:P = 24 * J + 30:Q = 40 * K + 31: GOSUB 38
    80: HPLOT 24 * J + 18,Q - 1 TO P,Q - 1: HPLOT 24 * J + 18,Q TO P,Q
3710 P = 24 * J + 31:Q = 40 * K + 33: GOSUB 3880: HPLOT 24 * J + 17,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 17,Q TO P,Q
3730 P = 24 * J + 32:Q = 40 * K + 35: GOSUB 3880: HPLOT 24 * J + 16,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 16,Q TO P,Q
3750 P = 24 * J + 33:Q = 40 * K + 37: GOSUB 3880: HPLOT 24 * J + 15,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 15,Q TO P,Q
3770 P = 24 * J + 34:Q = 40 * K + 39: GOSUB 3880: HPLOT 24 * J + 14,Q - 1 TO
    P,Q - 1: HPLOT 24 * J + 14,Q TO P,Q
3790 P = 24 * J + 35:Q = 40 * K + 40: GOSUB 3880
3800  HPLOT 24 * J + 13,Q TO P,Q
3810  NEXT K: NEXT J
3820  FOR I = 1 TO N: FOR J = 0 TO 8: FOR K = 0 TO 3
3830  HCOLOR= 0: HPLOT J * 24 + P1(I),K * 40 + Q1(I): HPLOT J * 24 + P1(I)
    + 12,K * 40 + Q1(I) + 20
3840  HCOLOR= 3: HPLOT J * 24 + P2(I),K * 40 + Q2(I): HPLOT J * 24 + P2(I)
    + 12,K * 40 + Q2(I) + 20
3850  NEXT K: NEXT J: NEXT I
3860  FOR I = 0 TO 159: HCOLOR= 0: HPLOT 1,I TO 23,I: HPLOT 217,I TO 250,I
   : NEXT I: HPLOT 1,1 TO 256,1
3870  END
3880  IF P > 240 THEN P = P - 240
3890  IF Q > 159 THEN Q = Q - 159:P = P - 12
3900  RETURN
```

An extra line has been added to tidy up the screen outline, ie to remove the odd half patterns which are on the edges.

```
3860  FOR I=0 TO 159:HCOLOR=0:
      HPLOT 1,I TO 23,I:
      HPLOT 217,I TO 250,I:
      NEXT I:HPLOT 1,1 TO 256,1
```

Six Of The Best

The hexagonal base is hidden in the triangular base and can be seen by changing the colouring scheme (Fig. 7). Unfortunately, the hexagonal element would require a larger screen than is available in low resolution if the same system of changing points were to be used. So, the solution has been postponed until another system of changing the shapes can be illustrated. Sorry.

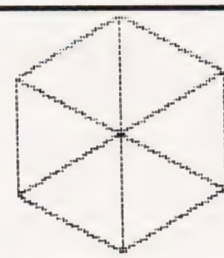
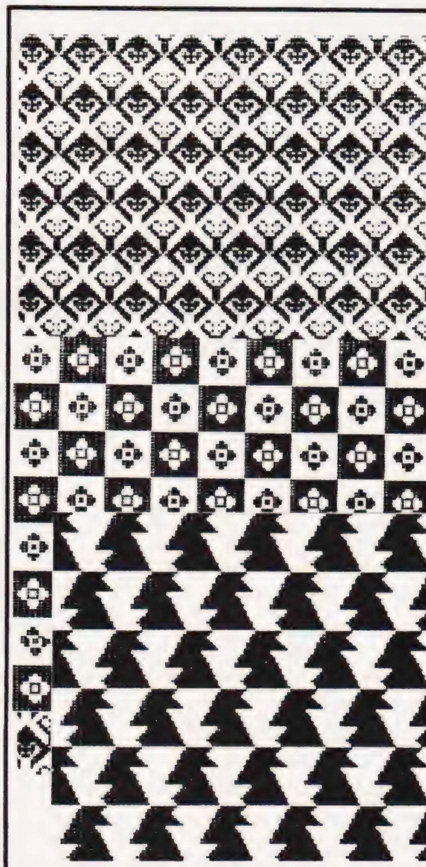


Fig. 7. The hexagon causes a few problems!



Some typical 'advanced' tile patterns.

MICHAEL ORWIN'S ZX81 CASSETTES

QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun."
from the ZX Software review in *Your Computer*, May '82 issue

"I had your Invaders/React cassette . . . I was delighted with this first cassette."
P. Rubython, London NW10

"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month."
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Richard Ross-Langley
Managing Director
Mine of Information Ltd.

CASSETTE 1
(eleven 1k programs)

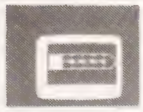
machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat
Basic:
I Ching, Mastermind, Robots, Basic Hangman PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k
Cassette One costs £3.80

CASSETTE 2
Ten games in Basic for 16k ZX81

Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
Cassette Two costs £5

CASSETTE 3
8 programs for 16k ZX81

STARSHIP TROJAN



Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photon torpedo tracking.

PRINCESS OF KRAAL An adventure game.

BATTLE Strategy game for 1 to 4 players.

KALABRIASZ World's silliest card game, full of pointless complicated rules.

CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.

SECRET MESSAGES This message coding program is very txlp qexi jf.

MARTIAN CRICKET A simple but addictive game (totally unlike English cricket) in machine code. The speed is variable, and its top speed is very fast.
Cassette 3 costs £5

CASSETTE 4
7 games for 16k

ZX-SCRAMBLE (machine code)

Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)

INVADERS (machine code)

GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft.

SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed).

LIFE (machine code)
A ZX81 version of the well known game.

3D TIC-TAC-TOE (Basic)
Played on a 4x4x4 board, this is a game for the brain. It is very hard to beat the computer at it.

6 of the 7 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman).
Cassette 4 costs £5

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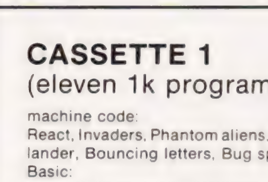

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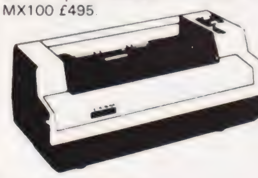
Two special offers:— If it is bought with the Vic20 we can supply the cassette recorder for £30-43. Alternatively, we will supply a free kit with each Vic20 to allow the use of an ordinary cassette recorder. Vic 20 £165. Ordinary cassette conversion kit £6. Vic20 cassette recorder £36-50. High resolution cartridge £27-95. Machine code monitor £27-95. Vic printer £189. Floppy disc drive £309. Ram cartridges:— 3K £24, 8K £35, 16K £57. Game cartridges:— Super lander, Alien or Avenger £15 each. Joystick £6-52.



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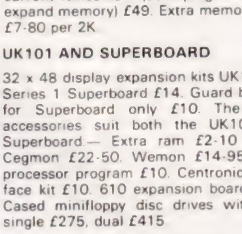
32 x 48 display expansion kits UK101 £9, Series 1 Superboard £14. Guard band kit for Superboard only £10. The below accessories suit both the UK101 and Superboard— Extra ram £2-10 per K. Cegmon £22-50. Wemon £14-95. Word processor program £10. Centronics interface kit £10. 610 expansion board £179. Cased minifloppy disc drives with DOS single £275, dual £415.

NEW GENIE 1 £299

EG3014 Expansion box with 16K/32K ram £199/£213. We are Cumana disc drive specialists for the Genie. Single sided disc drives:— 40 track £205, dual 40 track £345, 80 track £269, dual 80 track £469. Double-sided disc drives:— 80 track £399, dual 80 track £699. Double density convertor £72. Parallel printer interface £36.



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P Freebrey

The final episode in our BASIC programming for beginners series looks at the subject of arrays and how to use them.

Well, we have finally come to the end of this series of First Bytes and yet it seems like only yesterday that we started out by explaining the meaning of PRINT. Doubtless those of you who remember that, have progressed a very long way since then! I hope so.

One area a number of people have said gives them problems when first they meet it is that of the array. Arrays should not be so difficult to grasp and are in fact very useful things. Basically, they are really just another way of writing a variable and are much easier to use than variables with a discrete letter assigned to them such as:

```
10 A = 11
20 B = 12
30 C = 13
40 D = 14
```

Arrays are written in the form A(N) where N is the number of variables you wish to use. When talking of arrays we use the term 'elements' so using the example A(N), N is the number of elements in the array.

Watch Your Step

Say, for example, we wish to produce a memory testing game in which you are blindfolded and have to take 20 steps across a floor that has steps up or down for each step you take. You are led across the floor once — you must then start at the beginning and walk across without falling over! You could do this on the computer using ordinary variables and determining whether the steps required are up or down for each of 20 variables (A-T). You then test your memory by trying to repeat these steps 20 times. Using discrete variables, this simple game would require something in the order of over 200 program lines! The determination of up or down may take the form:

```
10 PRINT "FIRST STEP"
20 GOSUB 5000
30 PRINT A$
40 A = Z
50 GOSUB 8000
```

Line 20 of the above program determines whether each step is up or down assigning this string to A$ and assigning Z as 0 for up and 1 for down. Line 40 assigns your first variable, A, to the flag for up or down (0 or 1) and line 50 provides a delay enabling you to read what has been PRINTed and could be altered to suit the desired skill level. This little routine would then have to be repeated 20 times!

Having determined the course, you then have to negotiate it:

```
1000 PRINT "WHAT IS FIRST STEP"
1010 INPUT "UP OR DOWN "; B$
1020 GOSUB 6000
1030 IF A <> Y THEN 7000
```

Line 1030 assigns a flag 0 or 1 dependent upon the INPUT in line 1020 of up or down. Line 1040 checks to see if you have made the right choice for that step and line 7000 will tell you if you failed. This routine has to be repeated 20 times too!

This program does go on....and on! However, using an array can make things a little simpler. If you look at the program in Listing 1, you will see that only 25 lines of program are employed instead of over 200, simply by using an array. Note that when using an array you must specify the number of elements it may contain. For this we use the DIM statement (short for DIMension) in line 10. RND(3) in line 30 provides us with a random number between 0 and 1.

The useful thing about arrays is that you may assign to or call back an element of an array by having a variable within the brackets, for example, in lines 50, 80 and 210. This means that the information held in that element may be accessed within a FOR....NEXT loop. Arrays must be DIMensioned at the beginning of the program and must not be reDIMensioned again within the program (the ZX81 is an exception).

Hooray for Arrays

The array we have seen so far, A(N), is a one-dimensional array. Depending on the capabilities of your machine, you may have a two-dimensional array, A(M,N), a three-dimensional array, A(M,N,P), or more! A two-dimensional array is still only another way of representing a variable and is only one number and *not* two! Arrays may be either numeric, ie A(N), B(N), or they may be string arrays, ie A$(N), B$(N).

As we can utilise FOR...NEXT loops easily with arrays, we can also READ...DATA statements too. This means we can assign 10, 20 or 200 variables very easily indeed:

```
10 DIM D(20)
20 FOR I = 1 TO 20
30 READ A
40 D(I) = A
50 NEXT I
60  ..    ..    ..
70  ..    ..    ..
1000 DATA 1,3,5,6,8,2,5,8,2,9
1010 DATA 2,5,6,7,3,7,7,8,1,4
```

We have now assigned all the values in the DATA statements in lines 1000 and 1010 to the array D(20). They may represent the distance between railway stations or the number of shooting stars you saw on consecutive nights! *But,* they are now in a form you can work on:

```
100 Z = 0
110 INPUT X,Y
120 FOR I = X TO Y
130 Z = Z + D(I)
140 NEXT I
150 PRINT Z
```

The above little routine would give the sum of all elements between the Xth and Yth element. However, substitute for line 150:

```
150 PRINT Z / (Y-X)
```

and you get the average number of shooting stars seen between any specified consecutive number of nights!

Strung Out

Using string arrays can be just as simple, for example, you may wish to construct a maze for a game. The routine given in Listing 2 will display the directions you may move in for a grid pattern of five by five 'rooms'. The program is a little long-winded and there are shorter routines to give required directions but this should point the way!

One point to note with arrays is that most BASICs allow the use of the zero'th element, in other words, B(6) has seven elements:

```
B(0),B(1),B(2),B(3),B(4),B(5) and B(6)
```

This can be confusing and although you have dimensioned an array, eg B(6), you do not have to use B(0). Just remember that when you have told the computer to put aside a certain amount of memory. For example, M(50,20), does not look like much but it represents 1000 elements! A few machines (such as the Texas TI 99/4A) allow you to specify whether an array starts at zero or one.

Also remember that array elements must be positive; A(−2) will result in an error message (the variable an element refers to may of course be of either sign). When you DIMension an array at the beginning of your program do ensure you have enough elements for your needs. If you DIMension an array for ten elements, A(9), and try to assign a value to A(10) then again an error message will be displayed.

Arrays are often used for what are commonly called 'look-up tables' and a simple variant of this can produce a simple teaching program:

```
10 DIM A(20),A$(20)
20 FOR I = 1 TO 20
30 READ B$,B
40 A$(I) = B$
50 A(I) = B
60 NEXT I
70 R = 2 * INT(RND(5)*10) + 1
80 PRINT "TYPE IN YOUR ANSWER TO :"
90 PRINT A$(R)
100 INPUT "ANS. = "; X
110 IF X <> A(R) THEN 200
120 PRINT "*** WELL DONE ***"
130 GOTO 500
200 PRINT "YOU MADE A MISTAKE"
210 PRINT "THE ANSWER IS ";A(R)
500 FOR I = 1 TO 1000
510 NEXT I
520 CLS
530 GOTO 70
600 DATA 3*7,21,60/15,4,4*1.5,6
610 DATA 720+56,776,882/10,88.2,13*5
620 DATA 65,32+23,55,66/11,6,5*9,45
630 DATA       ..        ..        ..
```

```
 10 DIM A(20)
 20 FOR I = 1 TO 20
 30 IF RND(3) > 0.5 THEN 70
 40 A$ = "UP"
 50 A(I) = 0
 60 GOTO 90
 70 A$ = "DOWN"
 80 A(I) = 1
 90 PRINT "STEP NO. ";I;" IS ";A$
100 FOR K = 1 TO 1000
110 NEXT K
120 NEXT I
130 PRINT "HOW IS YOUR MEMORY ?"
140 FOR I = 1 TO 20
150 INPUT "STEP NO. ";I;" IS ";B$
160 IF LEFT$(B$,1) = "U" THEN 200
170 IF LEFT$(B$,1) <> "D" THEN 300
180 Y = 1
190 GOTO 210
200 Y = 0
210 IF Y <> A(I) THEN 300
220 PRINT "SO FAR SO GOOD !"
230 NEXT I
240 PRINT "**** WELL DONE ****"
250 PRINT "**** TRY AGAIN ****"
260 GOTO 310
300 PRINT "OH DEAR YOU FELL DOWN !"
310 END
```

Listing 1

Lines 20 to 60 assign the question to array A$( ) and the answers to array A( ). Note that the DATA statements are alternatively question, answer, question, answer, etc.

Line 70 generates an odd integer between one and 19. Line 90 PRINTs the question in that element of array A$( ) determined by the random number from line 70 and line 110 checks to see if your answer is correct.

```
10 DIM L$(5,5)
20 FOR I = 1 TO 5
30 FOR J = 1 TO 5
40 READ A$
50 L$(I,J) = A$
60 NEXT J
70 NEXT I
80 INPUT "CO-ORDINATES X (1-5) ,
   Y (1-5)";X,Y
90 IF X<1 OR X>5 OR Y<1 OR Y>5
   THEN 80
100 PRINT L$(X,Y)
110 GOTO 80
1000 DATA NSEW,NSE,NSW,SW,SE,SE,
     NSEW,SWE,NSE,EW
1010 DATA NSW,NSW,NE,NSE,SWE,SE,SWE,
     NSEW,NSEW
1020 DATA    ..        ..        ..
```

Listing 2

I hope that from these few examples you will be able to appreciate how useful the array can be.

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Mazogs is available from Bug-Byte and most good computer shops at £10. inclusive.

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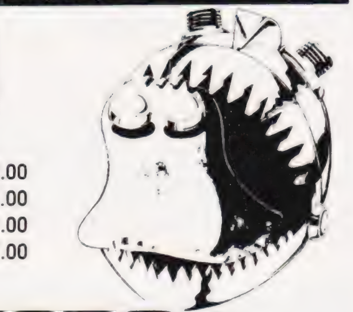
VIC-20



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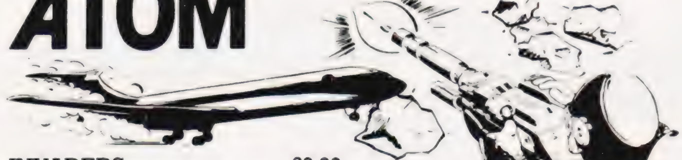

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PRINTOUT

Dear Sir,

I have acquired a BBC Model B Micro, with which I am well pleased. However, the UHF output is poor, especially compared to VIC and Atari systems which I have seen.

Not wishing to go to the expense of a RGB monitor, is there an encoder/modulator which would provide a better output on the market? Presumably, as the RGB outputs are available, the encoder could connect here, possibly to one of the new TVs which have video input.

Yours faithfully,
J Marshall
Southampton

(* I'm somewhat surprised at your comments on the quality. Try replacing the UHF lead supplied with a decent one, a true 75 Ohm UHF downlead with proper UHF connectors, and you may well see a remarkable improvement. Ensure also that your micro is not too close to the TV at this can de-tune the set or cause TVI in some cases. There is no point whatsoever in re-modulating the RGB signal, you would end up with exactly the same as you are getting out of the UHF output. The new style TVs with video input are for a composite signal, not a split RGB so it is, in theory at least, possible to regenerate a composite signal and use this. However, once again the quality would drop. I have had no trouble with either of the BBC Micros in our office — we use an NEC green screen monitor for one and a Microvitec colour monitor for the other but both have operated successfully on a conventional colour TV set (a 22" Ferguson TX) . . . but the latter is used with a decent lead and not the piece of string supplied! Ed *)

Dear Sir,

In view of the recently-published article by Owen Bishop entitled 'THE ARGUS', we would like to inform your readers and contributors that 'ARGUS' is a Registered Trade Mark of Ferranti plc in respect of computers and computer systems.

Yours faithfully,
FERRANTI plc

Dear Sir,

I was very interested to read the article on FORTH in Computing Today and I thought it might be instructive to compare the FORTH version of 'Towers of Hanoi' with a version in BASIC for the BBC Microcomputer. The program (see listing) displays the Towers in coloured graphics (MODE 7) and takes advantage of the ability to define recursive procedures in BBC BASIC, so is very comparable in operation to the FORTH version.

This BASIC version takes 187 seconds, as compared to 232 seconds for the published FORTH version.

Yours sincerely,
Tim Dobson
Acornsoft Ltd
4a Market Hill
Cambridge CB2 3NJ

```
  0 REM Tower of Hanoi Problem
 10 INPUT "Number of discs "F%
 20 N% = TIME
 30 K% = 13
 40 H% = 1
 50 @% = 2
 60 MODE 7
 70 VDU23; 10, 32, 0; 0; 0;
 80 DIM A$(12), P%3
 90 FOR I% = 1 TO 3:P%? I% = 20:NEXT
100 FOR I% = 1 TO 11 STEP 2
110 A$(I%) = CHR$(&91 + I% MOD7) +
    CHR$106 + STRING$(I% - 1,
    CHR$255) + CHR$53 + CHR$& 98
120 A$(I% + 1) = CHR$(&91 + (I% + 1)MOD7)
    + STRING$(I% + 1,CHR$255) +
    CHR$&98
130 NEXT
140 FOR A% = F% TO 1 STEP
    - 1:P%?1 = P%?1-H%:PRINT
    TAB((12 - A%)DIV2,P%?1);
    A$(A%);:NEXT
150 PRINT TAB(2,22)"Move disk   from Pile
    to Pile";
160 PROCH(F%,1,3)
170 PRINT CHR$30"It took "(TIME - N%)/
    100" seconds"
180 END
190 DEF PROCH(A%,B%,C%) IF A% = 0
    END PROC
200 PROCH(A% - 1,B%,6 - B% - C%)
210 P%?C% = P%?C% - H%
220 PRINT TAB(12,22)A% TAB(25,22);
    B%TAB(35,22); C%TAB(K%*B% - K%
    + (12 - A%)DIV2,P%?B%)CHR$%98
    TAB(K%*C% - K% + (12 - A%)DIV2,
    P%?C%) A$(A%);
230 P%?B% = P%?B% + H%
240 PROCH(A% - 1,6 - B% - C%,C%)
250 END PROC
```

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and we'll do our best to make them public.

Dear Sir,

Through the columns of your magazine could I please mention the formation of the RAF Coltishall Computer Club. At present the Club boasts 22 members and 12 machines including an Apple II and Video Genie both complete with disc and printer; four MZ-80Ks; a Superboard; a VIC 20; a PET and numerous ZX-81's. The club is also in the process of purchasing the BBC computer.

We meet on the first and third Thursday of each month in the Motor Club Social Centre at RAF Coltishall. The meetings usually start at 19.30 hrs.

Visitors to the Station are required to register at the Guardroom on arrival but before anyone travels any distance, I would recommend they contact me in case Service commitments prevent a meeting taking place.

Yours faithfully,
D C McCandless
Sgts Mess
RAF Coltishall
Nr Norwich
Norfolk
0603 737361 ext 308

Dear Sir,

Thanks for your superb early (March 27) April Fool. I refer to your article (joke?) about FAD-T in April's CT. I know there are some fairly perverse languages around but if FAD-T did indeed exist it would surely take the prize for programmers' 'nightmare of the year'.

What is more — naming no names — I can just imagine which machine it would be written for!

But seriously, features such as CORRUPT, FORGET and COME FROM plus the even-lines-only features could be very useful under certain conditions. Why doesn't some genius build these into a version of Pascal or BASIC?

Yours faithfully,
Phillip L Watson
Bedford

(* Are there any volunteers to write us a FAD-T interpreter? As Mr Watson suggests, the language might have real benefits as compared with some other programming tools! Ed. *)

Dear Sir,

I would be most grateful if you would give a small mention of the West Surrey Computer Club (WSCC) in one of your forthcoming issues. The club has been established some months now but while we have a fair sized membership, we would obviously like to hear from any of your readers who might wish to attend any of our monthly meetings in the Guildford area.

The aim of the club is to promote interest in computers and computing. We have a varied cross-section of members ranging from professional to hobbyists. Our club meetings consist of an informal session (bar facilities available, of course!). This is followed by a more serious session in which interest is focused on a particular subject which will be of interest to as many members as possible.

If you are able to give the club some small mention, I would be happy to receive any replies at the address below. Thank you for your trouble.

Kind regards,
Howard Webb
(Publicity Officer)
101 Park Barn Drive
Park Barn
Guildford
Surrey
GU2 6ER

Dear Sir,

With reference to Mr Dodiha's letter in the March issue of CT concerning the International Phonetic System, I think he is in fact referring to the alphabet used in the larger dictionaries, such as the full sized, multi-volume edition of the 'Oxford', where it is used to give the correct pronunciation of a word after its listing.

It consists of a mixture of Roman (English), Greek and Cyrilic (Russian) characters, each one having a distinct sound and is used to eliminate the ambiguities that exist in the spelling of different languages. For example, any English word that contains a 'C' could be replaced with an 'S' or a 'K', eg Sinderalla & Kat.

In the context of micros, there is the 'GRAND RAPIDS' speech synthesiser language (there is an implementation available for Apple to be used in conjunction with a Texas-type synthesiser chip) which takes a phonetic symbol and converts it directly to 'voice', and when used in conjunction with special control characters which define pitch, stress and length, complete words or sentences can be written as easily as BASIC and 'spoken' when executed. Watchers of the BBC Horizon programme would have seen it in action a few weeks ago.

I hope this is 'enlightening'.
Yours faithfully,
Mr D J Cranmer
W. Sussex

Dear Sir,

I have been a serious club chess player for several years and so, when I took up the hobby of computing, I inevitably became interested in computer chess. Partly because of the challenge and the fascination of the task and partly due to the dissatisfaction with the chess programs I bought, I would like to write a chess program for my computer.

However, I do not know where to start. I would be grateful if you could recommend some books on the subject, if any exist. The system I have is an Acorn ATOM so any material should be specific to the 6502 processor although general principles would also be helpful.

Yours faithfully,
C Cytera
Bristol

(* Apart from the original Sargon chess program written by Dan and Kathe Spracklen which has been extensively documented in various magazine articles, the only book on the subject that I am aware of is The Chess Computer Book by T D Harding. Published by Pergamon Press at £4.95 (ISBN 0 08 026884 6), it does not cover programming but looks at the various systems available on the market and identifies some of their strengths and weaknessess. If anyone else knows of a good book perhaps they could contact us and we'll pass the information to Mr Cytera. Ed. *)

Dear Sir,

I was very interested to read the article in April's CT about FAD-T, the new US programming language. It would seem, however, that your reviewer has got hold of the old V1.0. I recently had an opportunity to use the new self-compiling V1.1 which includes many extra commands such as IGNORE (treats all subsequent lines as REM statements), BUG (introduces a random syntax error into the program, useful for debugging training) and LIE X (returns a value which is not X).

A comprehensive range of graphics commands has also been added which include FILL (fills the whole screen with the existing background colour — unfortunately there is only one background colour available in the hardware), and the ingenious GOSUB which sends a little submarine hurtling across the screen, and, of course, RETURN which sends it back again. Very useful for games!

Only one function has been added, TAN(X), which prints X in a tan colour — a useful way of representing overdrawn balances on banking programs. I believe that some banks use this function along with the LIE command above.

I wonder how long it will be before we see programs in this new language. Keep up the good work.

Yours faithfully,
Dave Atherton
Manchester

Dear Sir,

A microcomputer club is now operating in Littlehampton. The club caters for a wide range of micros including the ZX family. We hold meetings on a bi-weekly basis at:

The Wick Amenity Centre,
Wick Farm Road,
Littlehampton,
West Sussex.

For more information, interested parties should contact myself on Littlehampton 7607.

P W H Cherriman
(Secretary)
Littlehampton

Dear Sir,

Over the past four or five months I have noticed an increasing decline in the amount of software presented each month.

February '82 saw the final demise of 'Softspots' which published a wide range of programs each month for a variety of machines.

This decline is due primarily to the increasing number of articles and reviews presented each month.

I must point out that I have nothing against such articles but merely feel that you must achieve some resonable sense of proportion.

To illustrate my point, in the last three months (March, April, May), only one program listing was given each month whereas in the corresponding three months in the previous year (1981) a total of twenty-seven programs were presented.

My view is echoed by all of my colleagues who read the magazine, and a number have since cancelled their order.

I am not aware of whether or not your readers have declined but if they have not, and those readers I have spoken to are a typical cross-section, then I feel they may well do so.

Yours faithfully,
M T Ward
Aylesbury
Bucks

(* The Softspot feature is by no means as dead as you suppose, indeed there are a number present in this issue. Your comments on the 'decline of software' appears to be based on the lack of small Softspots, one could hardly accuse The Valley of not being software in copious quantity!

What we are trying to do is to increase the overall quality of the software we publish. This involves the production of features containing software ideas and even complete programs, as opposed to the old system where the Softspots were used as an 'ideas' forum containing programs that did not always necessarily work.

If you simply want vast quantities of software, may I draw your attention to our new quarterly publication, Personal Software, the current issue of which contains some 77K of programs for the BBC Micro. Ed. *)

Dear Sir,

I was very pleased to see the series of articles 'Going FORTH' in the January to April issues of your magazine. I believe that Mr Peckett has given a valuable introduction to the language and its use. I do, however, have one or two minor criticisms concerning the use of some words. As Mr Peckett points out, MMS FORTH does have features which are 'non-standard', but some of these have slipped by and may cause confusion for those wishing to use other versions.

In the vast majority of available implementations of FORTH the word FILL has the following stack action:

FILL (addr count char . . .)

to fill count bytes, starting at 'addr' with the value of 'char'. This is in contrast with the description given for MMS FORTH of:

FILL (char addr count . . .)

Also, the Towers of Hanoi example uses definitions of the words SETUP, UPDATE and MOVE which, in many implementations, would be re-definitions of system words. In disc-based systems the re-definition of UPDATE, which usually controls the writing of screens to disc, may cause unfortunate effects.

I should also like to point out the existence of the FORTH Interest Group UK which exists to promote interest in and the use of FORTH and its related languages. The group holds meetings on the first Thursday of each month at 7pm in the Polytechnic of the South Bank. We also produce a bi-monthly newsletter and have a number of documents for sale to aid the implementation of FORTH on a range of popular micros.

Anyone who requires further information can contact me at Hackney College, Hackney Centre, Dalston Lane, London E8 1LJ or G F Filbey at The Polytechnic of the South Bank, Borough Road, London SE1. An SAE would be appreciated for our reply.

Yours faithfully,
R de Grandis-Harrison
Chairman, FORTH Interest Group UK

Dear Sir,

Like many Acorn ATOM owners I have been following Mr Peckett's series on FORTH with great interest; an implementation already exists for our machine.

Having been told more than once that FORTH programs are both fast and compact I must admit to a twinge of disappointment on reading the final article. The Towers of Hanoi program described is said to occupy 1037 bytes and move a 12-disc stack in 232 seconds. But, the ATOM manual also contains a 'Hanoi' program in BASIC which is also recursive.

Because of the restrictions on the depth of GOSUB nesting, it cannot handle more than 13 discs but moves the 12-disc stack in 250 seconds — almost as fast as the FORTH program — and incorporates the same kind of updated display although without the messages. What's more, the program only occupies 461 bytes and, by shortening the keywords and omitting spaces, can be reduced to under 400 bytes — less than one-third of the size of the FORTH version.

What, then, is all this fuss about? Or maybe it's time a long hard look was taken at the highly Extended Microsoft-type BASIC with which Mr Peckett was making his comparison?

Yours faithfully,
Derek L Haslam
Colne

(*Whilst I take your point, I think it only fair to point out that the Acorn ATOM's implementation of BASIC is much more like a high-level assembler than the Microsoft versions. It doesn't really represent a fair comparison but rather points out some of the strengths of the ATOM as against traditional machines. Ed*)

Dear Sir,

Your NASCOM 2 readers may be interested to know of a method of scanning the keyboard without delay.

By POKEing 4102 (103E Hex) with 223 (DF Hex) and then using INP(98), the value returned will be that of the last key pressed. Because the NASCOM's BASIC is primarily written in 8080 code which does not allow indirection, the following two blocks of code are set up in the workspace RAM:

```
103E DB xx     IN A, (xx)
1040 C9        RET
```

and

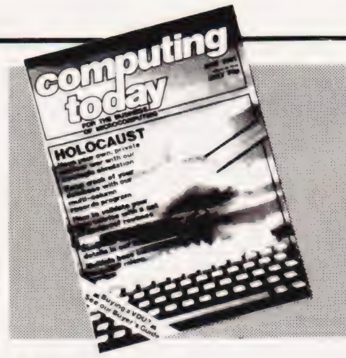
```
1006 D3 xx     OUT (xx), A
1008 C9        RET
```

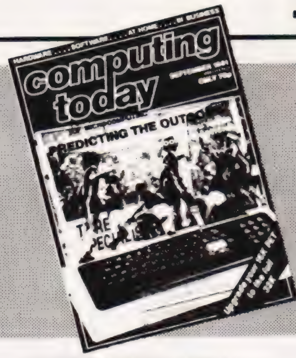
The BASIC POKEs the port number, xx, and then jumps to the appropriate routine above.

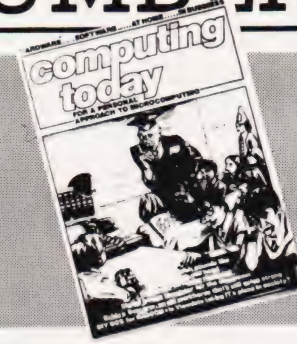
The INCHR routine can be accessed by CALLing the INP(x) function provided the correct argument is provided.

Yours faithfully,
Douglas Rice
Bishop's Stortford

BACKNUMBERS





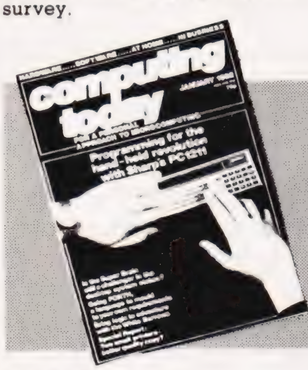


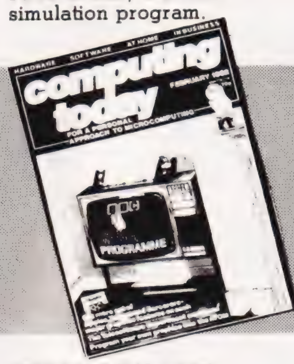
JULY 1981
Holocaust wargame, Data entry validation routines, Multiple column records program, Media survey.

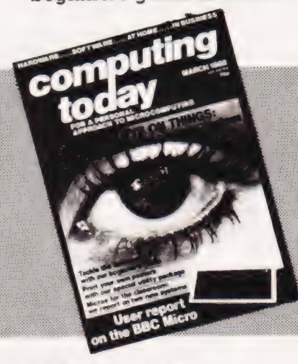
SEPTEMBER 1981
Football pools prediction Pt. 1, Connecting a printer to your micro,VIC reviewed, Upgrading PETs to 32K, Gladiator simulation program.

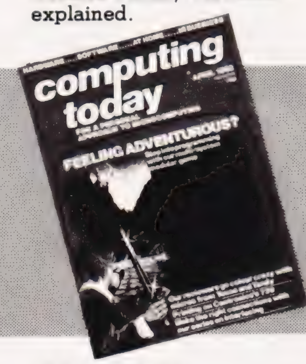
NOVEMBER 1981
Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, New beginners'guide to BASIC.

DECEMBER 1981
Micros in the classroom, Exidy's Sorcerer revisited, DIY DOS for NASCOM, Making sense out of Reverse Polish, Viewdata explained.









JANUARY 1982
Superbrain revisited, PC 1211 programming, Programming in the FORTH language, Tandy and Sinclair printers reviewed.

FEBRUARY 1982
The Computer Programme investigated, Graphics for Apple, Sorcerer and Tandy, User programmable graphics for ATOM.

MARCH 1982
User report on BBC Micro, DIY computerised security system, Terminology translated, Classroom computers reviewed.

APRIL 1982
The Valley program, TI 99/4 and Tandy Color Computer reviewed, Report on Centronics 737/739 printers, Interfacing series.

Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

If you are thinking of trying to plug some of the holes in your collection of Computing Todays then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then **now** is the time to order it because the chances are that it won't be in the list next month. All backnumbers cost £1.25 each.

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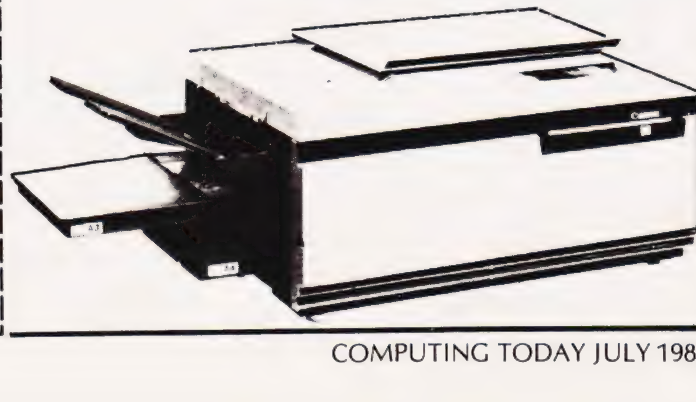

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Dr G J Marshall

They say that a picture is worth a thousand words but authors still seem to be producing words about pictures!

The graphics facilities of micros have always been among their most attractive features. The quality of graphics on micros is still improving, especially with the BBC microcomputer having an amazing resolution of 640 x 256 in its highest graphics mode and the secrets of the remarkable Atari colour graphics beginning to emerge. These kinds of facilities have endless applications in improving the attractiveness and quality of games; in making realistic simulations possible; and in the graphic presentation of information for business and many other purposes. In fact, the graphics hardware available with micros is rapidly approaching the stage at which it could display many of the graphic images shown in BBC television's recent Horizon programme on the latest research and development activities in computer graphics.

Of course, it takes a good deal of memory to represent a high-resolution display, and this can make micros which possess them relatively expensive. It can also mean that much of the available memory is used by the graphics, leaving rather less than one might wish for program storage. For these reasons (although the highest resolution displays are almost always the most attractive) when a program is generating graphic displays, there is, on many machines, a trade-off between the amount of memory needed by the program and the graphics. This can necessitate the use of lower resolution modes. Some micros, such as the PET, only possess block graphics. However, with a good understanding of the principles of graphics and the production of graphics displays, a lack of resolution in the display screen need not be particularly restricting; indeed, remarkably detailed images can be constructed using block graphics, given sufficient ingenuity.

The total lack of standardisation in the way that graphics facilities are provided by different micros presents a real dilemma to the author of a book on graphics. The variety of graphics facilities gives an author the choice of writing a book which is specific to one machine thereby correspondingly limting its appeal, or of writing a general book which touches on no particular machine to any degree. It is also extremely easy to fall between these two stools. I would venture the opinion that a book on graphics should deal with the principles of the subject to some extent in order to achieve a successful treatment; a straightforward collection of techniques may not be sufficient in itself, especially if it does not include the particular technique that one happens to need. We might also agree that a book on graphics should contain many good illustrations and indicate the relationship of computer graphics to graphics in general. Graphics, after all, were produced for many years prior to their production by computers.

There is undoubtedly a need for some good books on graphics, because although the micro manuals usually include one or two programs designed to show the machine's capabilities to good effect, they are usually rather limited in the help that they offer to the user in mastering the full potential of the graphics. The four books under review are among the few available about graphics on micros. One deals specifically with the PET, the second has some general material but its program content relates specifically to the Apple, the next gives general coverage, while the last one deals with principles and is not specific to any micro.

PET Graphics by Nick Hampshire is clearly specific to the PET explaining how to generate displays using the PET's block graphics. Should anyone doubt the quality of the displays that can be produced in this way, they need only look at the pages preceding each chapter which illustrate many ingenious ways of using the full dot resolution of the screen. On a 40-column PET, there are 25 screen lines and an 8 x 8 dot matrix for each character position; the dot resolution is consequently 320 x 200. The full dot resolution can be used in a display because there are, for example, eight different horizontal bar graphics characters, one for each row of the charater dot matrix. Hampshire gives many techniques for using these characters, and other similar ones, for generating 'pseudo high-resolution' displays; having mastered these, the PET user need envy the graphics facilities of no other micro. I admit to being keen on block graphics and to being intrigued by the devious methods which are sometimes needed to manipulate them, but the quality of Hampshire's displays speak for themselves.

The book starts from absolute basics by explaining how displays can be produced using first PRINT and then POKE commands. While programs written in BASIC are presented throughout the book, attention quickly moves to machine code programs. In fact, the machine code programs are organised into a graphics package designed so that it can be loaded into the top of the memory. In an innovation that I particularly admire, the machine code package is available on disc in a fully tested form. There is consequently no need to spend a lot of time typing in programs only to suffer the frustrations caused by the inevitable errors. The package itself includes routines for drawing horizontal bars, vertical bars and borders around a particular screen area, as well as for causing a particular screen area to be displayed in reverse field.

There are chapters on screen and block scrolling, double density plotting and displaying and moving large characters. I am sure that any PET user interested in graphics would find this book indespensable. After mastering its contents, the reader should have learnt as much about the PET and machine code programming as he would have learnt about graphics.

My only real quibbles, and they are minor, are that in such a good book the quality of the English and the spelling are in places so poor as to be distracting, and the table showing the block graphics characters is nowhere near the quality of the ones published in Computing Today.

Computer Graphics Primer by Mitchell Waite contains three chapters and two short appendices. The first chapter is a truly dire general introduction. It begins: 'Rod leaned slightly forward, his eyes intently fixed on the screen before him.'. Enough said, I should think. I would recommend that nobody waste any time reading this chapter. Do, however, look at the pictures as they include some fine examples, in colour, of what computer graphics can achieve. The second chapter deals mainly with the hardware techniques used by computer graphics equipment. Not all of the material is relevant to graphics on micros, but the material is good and is quite well presented. The third chapter, called 'Graphics programming', deals with programming the Apple II in high-resolution graphics mode. It covers general plotting, shape tables, transformations and animation. Some of the material covers the same ground as Apple's Applesoft manual, but the book does complement and extend the treatment given in the manual. To me, though, this book is a pretty expensive way of obtaining a minor extension of the Apple manual which, as it happens, is rather good.

Graphics on Microcomputers by J E Lane is in the NCC's Computing in 80's' series. It claims to review 'the current trends in graphics on low-cost microprocessor-based systems' and to provide 'information on a number of commercially available systems'.
Well it does — but it contains very little that could not be found in an 18-month old copy of Computing Today. The book presents the specifications of the PET, Apple and Acorn Atom, among others, but it makes no mention of the BBC Microcomputer, the Atari machines or of Hewlett-Packard's microcomputer-based graphics equipment. A look at 'picture building' techniques is also promised, and this would be interesting and valuable. However, what is presented is a copy of two magazine articles which have been re-written sufficiently to avoid violating the copyrights. (To declare an interest, one of these articles is by the reviewer.) I found this book very disappointing. To pay the asking price for 57 typed A4 pages reduced to A5 seems expensive, but given the outdated and un-original contents it is exorbitant!

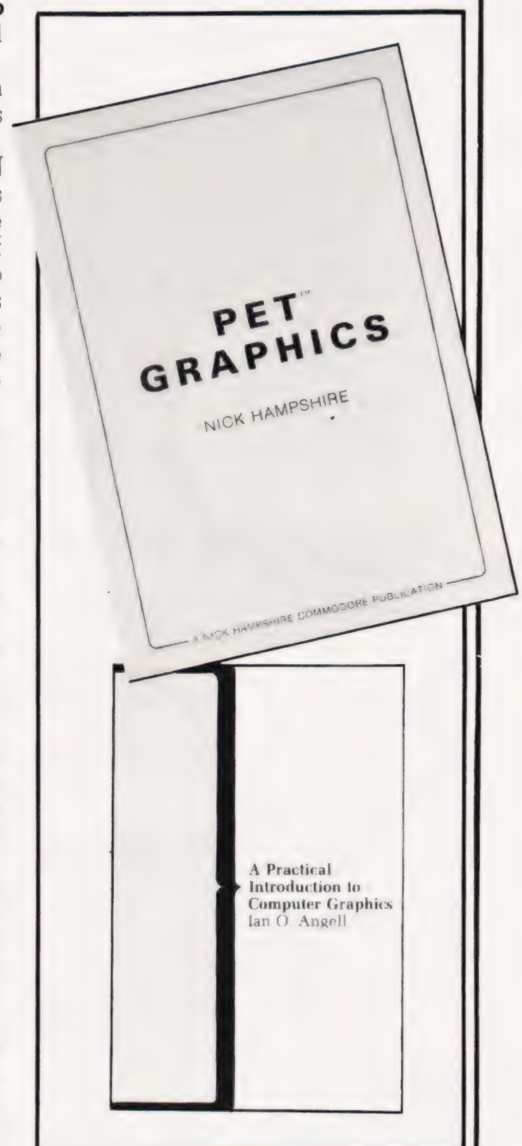
A Practical Introduction to Computer Graphics by I O Angell is not aimed at micro users at all, really. Its programs are written in FORTRAN: the graphics commands are based on the Calcomp library, which is a library of FORTRAN subroutines providing graphics facilities originally intended for use with Calcomp graphic plotters. If this does not sound promising, do not despair. The programs presented in the book can all be readily translated to BASIC, and the graphics routines either have familiar names and purposes or can be readily related to the commands available for graphics on any micro.

Besides providing a practical introduction to graphics (as promised in its title) the book also gives the best introduction to the underlying principles of computer graphics that I have read. It deals with two-dimensional geometry in a painless fashion, followed by two-dimensional transformation. Clipping and covering are also treated — an image is clipped so that only the parts of it within the plotting area are shown, while covering (the reverse of clipping) permits areas of the image to be suppressed.

The book then moves on to deal with three-dimensional objects, showing how to model, transform and generate perspective views of them. This leads on to a treatment of some rather advanced topics including the removal of hidden lines and surfaces in three-dimensional scenes and animation. Throughout the book there are many superb examples of computer-generated images.

After reading this book, it should be possible for the reader to develop his own graphics software for any of a wide variety of applications. Many example programs are given, but the important thing is that all the underlying principles are presented and are clearly explained. I am confident that there are no real problems in converting the programs in the book to BASIC programs using the graphics commands of any of the micros having high-resolution displays, and I thoroughly recommend the book to anyone with an interest in graphics.

It is interesting to reflect that both the successful books, by Hampshire and Angell, contain good illustrations. Finally, the only book which discusses the design of graphic images prior to their actual production is Hampshire's.



The books included in this month's selection were:

PET Graphics by Nick Hampshire, published by Commodore Business Machines (1981), £10.
Computer Graphics Primer by Mitchell Waite, published by Sams (1979), £10.45.
Graphics on Microcomputers, by J E Lane, published by NCC (1981), £4.
A Practical Introduction to Computer Graphics, by I O Angell, published by Macmillan (1981), £5.50.

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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

Controlling That Cursor

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system offers pre-programmed function keys which, we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its *de-facto* standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOMe cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTroL key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

To indicate more than one of the above, an optional number can be placed within the brackets; [4CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that ***most*** of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was ⌴ and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

The Graphic Solution

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in Computing Today.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR$( ) codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

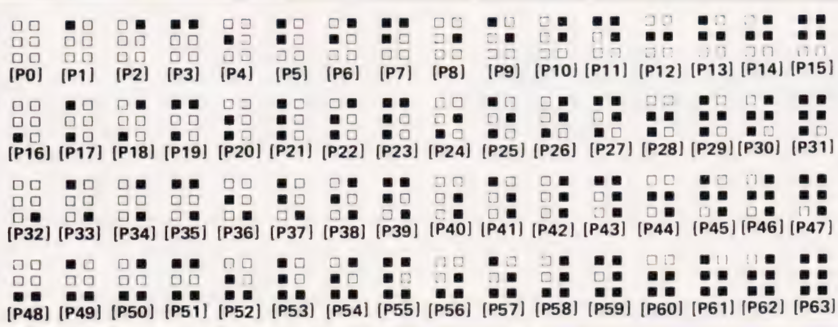

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

Making REMarks

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
4000 INPUT "THE NUMBER OF ENTRIES ";A$
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when renumbering after removing the REMs.

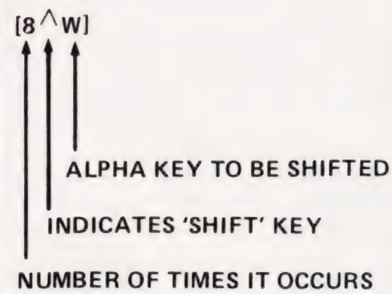

Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To converts a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

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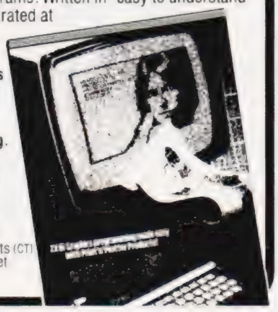

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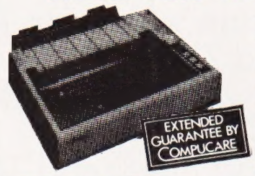

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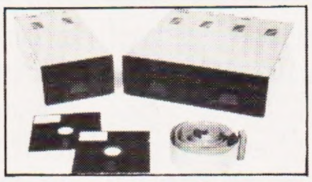

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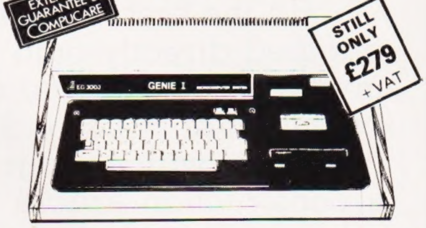

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